

ANNUAL REPORT
OF THE
MARYLAND AGRICULTURAL COLLEGE,
FOR THE YEAR
1890.



COLLEGE PARK,
PRINCE GEORGE'S COUNTY, MARYLAND.
JANUARY, 1891.

BALTIMORE:
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(Letter of Transmittal.)

To His Excellency,

ELIHU E. JACKSON, Governor,

and President of the Board of Trustees,

Annapolis, Md.

SIR:—Herewith I have the honor to transmit the Annual Report of the Maryland Agricultural College and the Agricultural Experiment Station, for the year 1890, made in accordance with the laws, of which extracts are given below. As thereby required, copies of this report will be sent to the Secretary of Agriculture and to the Secretary of the Interior, and to all other colleges similarly endowed.

Very respectfully yours,

HENRY E. ALVORD,

President of the College.

MARYLAND AGRICULTURAL COLLEGE.

January 29, 1891.

EXTRACTS FROM THE LAWS.

Act of Congress, approved March 2, 1887, Sec. 3: "It shall be the duty of each of the said Stations, annually, on or before the first day of February, to make to the Governor of the State in which it is located, a full and detailed report of its operations"

Act of Congress, approved August 30, 1890, Sec. 3: "An annual report by the President of each of said colleges, shall be made to the Secretary of Agriculture, as well as to the Secretary of the Interior, regarding the condition and progress of each college, including statistical information in relation to its receipts and expenditures, its library, the number of students and professors, and also as to any improvements and experiments made under the direction of any experiment stations attached to said colleges, with their cost and results, and such other industrial and economical statistics as may be regarded as useful, one copy of which shall be transmitted by mail, free, to all other colleges further endowed under this Act."

ANNUAL REPORT

OF THE

Maryland Agricultural College,

FOR 1890.

The last Report of the Maryland Agricultural College was made by the Board of Trustees, for the years 1888 and 1889; it was submitted to the General Assembly of the State in January, 1890, and was published by order of that body. In accordance with existing laws, as per extracts printed herewith, the present Report will relate to "the condition and progress" of the College and "the operations" of the Experiment Station connected therewith, for and during the full calendar year of 1890. The accompanying financial statements conform to the fiscal years of the College and Station respectively, as later explained.

RECENT LAWS AFFECTING THE COLLEGE.

The State Fertilizer Law:—The only action of the last General Assembly relating to this College, excepting the authority for publishing and distributing its report and the usual State appropriation, was the new law regarding Commercial Fertilizers, which forms Chapter 387, of the Laws of Maryland of 1890. Under that statute new and increased duties are assigned to the College and such as, if thoroughly executed, cannot fail to be of direct economic value to the farmers of the State. Unfortunately, the law made entirely inadequate provisions for maintaining the work involved, and while the College Board of Trustees have done all they could, it is evident that the interests of the producers of fertilizers, on the one hand, and of the consumers, on the other, cannot be fully conserved, until means are granted for better accommodations in which to do the work. There are serious defects in the new fertilizer law which manufacturers, farmers and the College, should unite in bringing to the attention of the next legislature.

The New Congressional Endowment.—The Act of Congress commonly known as The New Morrill Act, approved August 30th, 1890, for “the more complete endowment and support of the colleges for the benefit of agriculture and the mechanic arts,” established under the Land-Grant Act, or “Morrill Act” of 1862, is of the utmost importance to this College. The only permanent endowment fund of the institution was created by the Land-Grant of 1862, is held in trust by the State and yields an annual income of but little over six thousand dollars. This new law grants from the Treasury of the United States, derived from the proceeds of public lands, an annual sum of money, beginning with fifteen thousand dollars for the last collegiate year, and sixteen thousand dollars for the present collegiate year, and increasing one thousand dollars a year, until the annual grant reaches twenty-five thousand dollars, at which it continues as a permanent appropriation. This more than doubles the past income of the college proper, and must give new life to the institution, make its foundation sure, strengthen and broaden its work, and ensure its future prosperity and usefulness. The law restricts the expenditure of this new income; it is “*to be applied only to instruction in agriculture, the mechanic arts, the English language and the various branches of mathematical, physical, natural and economic science, with special reference to their applications in the industries of life, and to the facilities for such instruction.*” There are other limiting provisions, and following the plan of the Act of 1862 (by the same author) the whole scheme is designed to form a compact between the United States and the State, by which the former provides the money for instruction and the facilities therefor, class-room accessories and the like, and the State furnishes land and buildings, maintains the real estate and defrays the general expenses of administration. In order that Maryland might have the immediate benefit of the Act, the latter provided that the assent of the State to the terms of the law, might be given by the Governor, pending the action of the next General Assembly. This assent has been given, and the first payment, \$15,000, has been made by the United States to the State Treasurer, and by that officer transferred to the College Treasurer. The second annuity will soon follow, being now due. This increased income has become too recently available to be used with much effect at the time of preparing this report; but during

the closing months of the year 1890, the work of the College has been strengthened and enlarged, as later described, and before the end of the present collegiate year, changes and improvements at the institution will be very marked.

The Eastern Branch, for Colored Students:—Attached to the appropriating clause of the new law is this proviso,—“That no money shall be paid out under this Act, to any State or Territory for the support and maintenance of a college where a distinction of race or color is made in the admission of students.”

The facts on this point, as to Maryland, having been submitted to the Secretary of the Interior, that official, who is charged with the administration of the Act, decided that all its benefits were applicable to this State and only to the Maryland Agricultural College. The same officer further decided, that to meet existing conditions in certain States, and conform to the custom of separate school provisions for the races, any State College might maintain a distinct department or branch, for the exclusive accommodation of colored students, and if of like character with the parent institution, the terms of the law would be fulfilled. The Board of Trustees of this College desired to fully meet the spirit of the new law, and decided to establish as a special inducement for colored students, a separate Branch of the College. To save time and economize expenditure, advantage was taken of the existence of a school for colored persons at Princess Anne, in Somerset county, known as The Normal and Industrial Branch of the Morgan College of Baltimore. A legal contract has been made with the representatives of that institution, by which the school at Princess Anne becomes the Eastern Branch of the Maryland Agricultural College and will so continue until the meeting of the next General Assembly of the State. At this Branch instruction will be given (as has been done heretofore) in agriculture and the mechanic arts and in other branches specified by the law of Congress. To support such instruction and make the Eastern Branch of “like character” with the College proper, the new income of the latter is shared equitably with the Branch, the first apportionment being made upon the basis of the division of the public school funds of the State, between the schools for the white and colored races.

The Maryland Agricultural College consequently continues to be the only institution in this State recognized by law as entitled to the benefits of the Act of Congress of August 30th, 1890, and continues to admit students without distinction of race or color, but will assign all colored students admitted, to its Eastern Branch, which is "an educational institution of like character." This College thus conforms to the spirit of the law, as well as its letter, and to the rulings of the Interior Department. Similar provisions have been made in other States, with the approval of the Secretary of the Interior. This plan meets with favor because it simplifies and harmonizes the work and economizes the expenditure of the federal grant for industrial education, in any State. Two or more branches or departments can be conducted more efficiently under one general organization and can be more economically and more equitably supplied and maintained, than is possible with the same number of separate and distinct institutions, with the general expenses of administration incidental to each one. The former also permits greater flexibility of management, combined with greater uniformity in conduct, tending to enhance efficiency and the results of the work, as a whole.

CHANGES IN THE BOARD OF TRUSTEES.

A full list of the Board as at present constituted, will be found in the appendix. The Hon. Robert F. Brattan, President of the Senate, the Hon. John Hubner, Speaker of the House, and the Hon. Edwin F. Brown, State Treasurer, became, by the encumbrance of their respective offices, members of the Board. Jeremiah P. Silver, Esq., of Harford county, was re-appointed from the Second Congressional District for the term ending in 1896, and Wm. T. Biedler, Esq., of Baltimore City, was appointed for the same term, to the vacancy existing from the Fourth District. No other changes have occurred in the *personel* of the Board, since the last published Report.

At the meeting of the Board in June, Dr. Jos. R. Owens, of Prince George's County (and formerly of Anne Arundel) was elected Registrar and Treasurer of the College, to fill the vacancy which had existed for some months. Dr. Owens filed his bond and entered upon duty at the beginning of the new fiscal year of the College, the first of September.

CONDITION AND PROGRESS OF THE COLLEGE.

The year of 1890, as a whole, has been one of material advance for the College, in several particulars. The public sentiment towards the institution, within the State, has steadily improved. The income has been largely increased. The condition of the land and buildings has been improved. Additions have been made to the teaching force. The work of the class-rooms has been strengthened and enlarged. Deficiencies in equipment have been supplied. The enrollment of students has been comparatively large. The standard of scholarship, and the discipline and general *morale* of the institution have been improved, especially towards the close of the year. At the time of preparing this Report, the condition of the College in all these respects, is reasonably satisfactory.

During the earlier part of the year, there was a period of disquiet and an element of discord, which had an unfavorable effect upon studiousness and discipline. But the causes were ascertained and remedies applied which effectually corrected the difficulty. At the opening of the Autumn session, the attendance was less than expected, and one class was smaller than the average of the last three years. But the number of students has since gradually increased, and if those be included who have given notice of entering and at this writing are daily arriving, the total number in the college classes is larger than it has been for at least ten years. A full list of the students enrolled during the year will be found in the appendix; this includes the graduating class of 1890 and some who have not been in attendance the full year, as well as a few already mentioned as enrolled in 1890 but joining in January of 1891.

Free Scholarships.:—In November last, the Board of Trustees adopted a system of free scholarships. Under this, the College will maintain at all times one scholar from every County in the State and the several Legislative Districts of Baltimore city, to be awarded by the respective School Boards, upon the result of a public competitive examination. Persons holding scholarship certificates are admitted to the College upon the usual entrance examinations, and so long as they maintain a satisfactory standard

of scholarship and deportment, all charges are remitted to them, except a fee of five dollars per month, to be paid by each, to cover certain incidental expenses. The College thus makes provision for educating at all times, twenty-six worthy young men, from all parts of the State, at a total cost considerably less than their actual living expenses would be at home. It is hoped that by making these opportunities known, encouraging competition, and proper care in the examinations by the School Boards, these scholarships may be filled by some of the most promising and most deserving pupils of the public schools in the several Counties and Districts. Thus far only a portion of these scholarships have been filled, but it is expected that the system will be in full and successful operation, before the close of another year.

Changes in the Faculty:—At the opening of the current collegiate year, the previously existing chair of Natural History, was divided into three parts, based upon the natural kingdoms. Two new professorships were created and filled, the other being left for later action. Arthur C. Wightman, Ph. D., lately Assistant in the Biological Department of Johns Hopkins University, was chosen Professor of Zoology and Comparative Anatomy,—and Thomas L. Brunk, B. Sc., who lately occupied the same chair at the Texas Agricultural College, was chosen Professor of Botany and Horticulture. Prof. Milton Whitney, formerly of Johns Hopkins University and lately of the University of South Carolina, has been engaged as Special Instructor in Geology and Soil Physics, and it is hoped to soon raise this position to a full professorship and secure the continued services of Prof. Whitney. An Assistant Professorship of English and Mathematics was also established, and Prof. A. Peyton Works, of Frederick County, was chosen to this position. The duties of Professor of Agriculture were assigned to the President in June, for the ensuing year, with assistance to be rendered by officers of the experiment station and others. Near the close of the year it has been decided to employ instructors in wood and metal work, and shops for these practical lessons are now being fitted for the purpose. It has also been arranged to soon provide other special instruction and several courses of lectures by well-known specialists. A list of the Faculty as at present constituted, is given in the Appendix.

Work of the Departments,—and its Quality. Reports from the several professors upon the work of their respective departments of the college, are appended to this report, and attention to the details set forth therein, is respectfully invited. Collectively, they show a steady broadening of the range of instruction, and this is accompanied by improvement in its quality and increased effort to make it as practical as possible in methods of presentation and in application.

A very gratifying testimonial to the nature and quality of the work done at this College, has lately been received from the Johns Hopkins University. The authorities of the University, after a careful examination of the kind and quantity of the instruction here given and of the competency of the instructors, have given formal notice that hereafter, any regular graduate of the College, holding its diploma, will be accepted at the University, without examination, for such advanced courses of study as naturally follow the work of this institution.

From the reports of the several departments is taken the following summary of the course of instruction. Agriculture and Horticulture are taught theoretically and practically, one or the other being a part of the work of every week throughout the course,—with constant illustrations in the class-room, museums, laboratory and stable, on the farm and at the Experiment Station. The mineral, vegetable and animal kingdoms are studied under the different professors of natural history, and this work embraces physical geography, climatology, geology, mineralogy, botany, zoology (including entomology,) and comparative anatomy. Correlative lectures are given by specialists, including the elements of veterinary practice. The chemical instruction is first general, then special; it is made very full and thorough, with abundant laboratory practice, particular attention being given to agricultural analyses. In the department of physics, the mechanical powers and the physical forces of nature are taught, with the properties of matter, sound, light, heat, electricity, magnetism and their economic applications; the illustrative apparatus for this department is being rapidly increased, and the equipment will soon be ample. Particular attention is given to a full and continuous course in English, that all the other instruction of the student

may be made available by giving him a free and accurate command of his mother tongue, in speaking and writing; this course embraces language lessons and literature, logic, rhetoric, elocution and general history, constitutional history, civil government and political economy. A special aim is to make the graduate acquainted with and appreciative of, the rights, privileges and duties of citizenship. Optional courses of study are offered, in the German, French and Latin languages. In mathematics, the usual college course is taught, but with special reference to practical application; this includes every-day calculations, computations and measurements in ordinary business and country life, and also plane surveying, dividing lands, mapping, road-making, grading, draining, water-works and the principles of building and construction. This line of work is accompanied by free-hand, geometrical and topographical drawing. As required by law, military drill occurs four days in the week, the weather permitting, and some theoretical instruction is given in tactics, field operations and military history.

Library, Museum and general Equipment:—Additions are gradually made to the college library, and including that of the Mercer Literary Society, the number of volumes now owned is about three thousand. Nearly as many more are at the Experiment Station. But the large libraries in the city of Washington are so easily reached by professors and students, for special purposes, that it is the policy of the College to acquire only such books as will be serviceable for constant reference in connection with the work of the different departments. For this purpose purchases are made as required, and several hundred dollars will be expended in this way, during the next few months. Within the year, the library of the College has received a very handsome gift from Hon Charles E. Coffin, of this county, in the form of a set of the English and American Short-Horn Herd Books. This set is complete with the exception of a few of the most recent volumes, and it is a rare and valuable addition to the books for agricultural reference.

The National Museum and other collections in Washington are systematically used for purposes of instruction, professors accom-

panying the students for this purpose. Consequently the College makes no effort to have a museum of its own, beyond the material constantly needed for work in the various sciences taught.

In general equipment, or “facilities for instruction,” this College has in past years been sadly deficient. But this want is now being rapidly supplied, and the new income will enable several thousand dollars to be invested in permanent equipment as fast as purchases can be judiciously made. Within a short time, this College will have greater facilities for instruction in all its chosen lines of work, than any other college in Maryland.

THE FINANCES.

The last financial report of the College, as presented to the General Assembly, and published, was for a year and a fraction, and closed with the month of August, 1889. The report of the College Treasurer, printed in the Appendix, is for the fiscal year, from September 1st, 1889, to August 31st, 1890. This report exhibits the receipts and expenditures, sufficiently classified for general information, for one full college year. The accounts for that year were closed, however, before the receipt of the first payment of the new income of the College, under the Act of Congress of August, 1890,—hence that will be embraced in the next annual report. This new law requires an annual report from the College Treasurer to the federal officials, “on or before the first day of September of each year,” and this will conform to the fiscal year of the College, as already established.

The fiscal year for the Experiment Station, the accounts of which are kept separate from those of the College, necessarily conforms to that of the United States Treasury, from which its entire income is derived, and to which its reports are rendered. Accordingly, the third annual financial statement for Experiment Station, which is appended, is for the year ending June 30th, 1890.

The debt of the College, which has been a great burden for the past few years, is being steadily and satisfactorily reduced. To this has been applied the greater part of the annual grant from the State Treasury. The following comparative statement shows

how fast the debt has been paid and the changes which have been made in its form, during the last three years.

COMPARATIVE STATEMENT OF COLLEGE DEBT.

FORM.	June 30th, 1888.	Aug. 31st, 1889.	Aug. 31st, 1890.	Dec. 31st, 1890.
Secured; income discounted....	\$ 6,000 00	\$ 4,500 00	\$ 3,000 00	.....
Negotiable Notes.....	5,209 38	3,200 00	1,800 00	\$1,500 00
Certificates of Indebtedness.....	.....	5,300 00	5,300 00	5,300 00
Open accounts.....	7,694 55	500 00	.....	.....
Unadjusted claims.....	1,033 09	.....	.....	.....
Totals.	\$19,937 02	\$13,500 00	\$10,100 00	\$6,800 00

Of the seven certificates of indebtedness now outstanding, three mature the first of October, 1891 and the remainder one year later. It seems to be now desirable to pay the debt no faster than required by the maturity of the obligations and the pressure of creditors, as in this way more funds can be applied to other things which are so much needed in the growth and development of the institution.

The business affairs of the College have received particular attention during the year, and every effort made to keep the expenditures within the prescribed limits. The following statement, which is taken from the records, gives the receipts for the past year as estimated in June, 1889,—the appropriations then made by the Trustees,—and the actual condition of the corresponding accounts at the close of the year.

FINANCIAL STATEMENT,—1889-'90,—FROM THE RECORDS.

I. INCOME.

Receipts for Year 1889-'90, as estimated on June 14th, 1889.	Actual Receipts from Ledgers, 1889-'90.
From Land-Scrip Fund.....\$ 6,200	.....\$ 6,213 45
“ State Donation..... 6,000	..... 6,000 00
“ Fertilizer Law Income..... 800	..... 1,007 00
“ Loans (borrowed)..... 3,000	..... 3,000 00
“ Students and boarders..... 7,000	..... 7,057 75
“ other sources.....	..... 233 49
Total for the College.....\$23,000	.....\$23,511 69
From U. S. for Expt. Station..... 15,000	..... 15,000 00
Aggregate.....\$38,000	Aggregate.....\$38,511 69

II. OUTLAY.

Appropriations of the College Income made by the Board of Trustees, June 14th, 1889.	Actual Expenses for College Year,—1889-'90,—from the Ledgers.
For Debt and Interest thereon.\$ 6,200	.....\$ 6,745 87
“ General Expenses, Advtg., &c.. 800	..... 881 33
“ Repairs and new sheds..... 1,600	..... 1,634 93
“ Farm expenses.... 250	..... 204 79
“ Board walk..... 150	..... 150 00
“ Salaries and Equipment..... 7,000	..... 6,782 32
“ Domestic Department.... 7,000	..... 6,422 71
Total for the College.....\$23,000	.....\$22,821 95
For Experiment Station..... 15,000	..... 15,000 00
Aggregate.....\$38,000	Aggregate.....\$37,821 95

The following explanation of the different sources of income and its appropriate application, is repeated from former reports:—

1. The State donation, or annual appropriation, is the general maintenance fund and may be considered as providing for the Department of Administration. Upon this exclusively, the College must rely for all additions, repairs and improvements to the buildings and grounds, for advertising, taxes, insurance and general incidental expenses, and it is the only income applicable to the payment of interest and the reduction of the debt.

2. The income from the Land-Scrip Fund and from the United States Treasury, under the new endowment, is clearly stated in the laws to be for the support of the Department of Instruction, for the salaries of professors, lecturers and instructors, and for equipment, or “to be applied only to instruction * * and to the facilities for such instruction.”

3. The income from students and from professors or others boarding at the College, as well as the receipts from the farm, is applied to the support of the Domestic Department. Against this is charged all the household expenses, for supplies, labor, fuel laundry, and also books and any rebates to students or special expenses on individual account. There has been a small balance in favor of the College, on this account, but the new Scholarship plan will operate to cause a balance the other way.

4. The fees received under the Commercial Fertilizer Law, are for a specific purpose, to be expended in defraying the cost of chemical analyses and other duties imposed upon the college in connection with this law.

5. The Agricultural Experiment Station is wholly supported by the annual appropriation from the Treasury of the United States and is conducted within its fixed income of fifteen thousand dollars. While the College and Station are mutually beneficial in various ways, neither depends upon the other for financial aid.

An estimate follows, of the income of the institution for the current collegiate and fiscal year.

ESTIMATED INCOME FOR CURRENT FISCAL YEAR.
FROM SEPTEMBER 1ST, 1890, TO AUGUST 31ST, 1891.

1.	From the U. S., for the College,—Act of Aug. 30th, 1890.	\$16,000
2.	“ “ Land-scrip Fund,—Act of July 2d, 1862.	6,200
3.	“ “ State of Maryland,—appropriated March, 1890.	6,000
4.	“ “ Fees under the State Fertilizer Law.	1,000
5.	“ “ Students and other boarders.	6,000

	Total for the College proper.	\$35,200
6.	“ “ U. S., for the Agr'l Expt. Station.	15,000

	Aggregate.	\$50,200

It should be noted in connection with the above statement, that while the institution, as a whole, has an income of upwards of fifty thousand dollars (\$50,000) a year, the only direct expense to the State, is the use of the land and buildings, (half of these being owned by the original College stockholders,) and the cost of maintaining and improving the real estate and defraying the expenses of general administration.

The New Income:—Under the new law, already mentioned, the first payment, already received, is for the year ending June 30th, 1890. By a proper interpretation of the law, sustained by Departmental decisions, the sum of \$15,000, thus first paid to the State of Maryland, constitutes an equipment fund, applicable to the purchase of “facilities for instruction” for the Maryland Agricultural College, proper, that being the only institution in the State, from July 1st, 1889 to June 30th, 1890, (the period for which this sum was specifically appropriated) which was then “established in accordance with an act of Congress, approved July 2d, 1862.”

The second annuity under the new law, being \$16,000, is now over due and will be soon received. This is applicable to the year ending June 30th, 1891, and for both instruction and facili-

ties therefor in connection with the conduct of the College and its newly established Eastern Branch.

THE PROPERTY.

The condition of the land and buildings of the College was described in the last published Report. Since that time several hundred dollars have been expended in further repairs, chiefly upon the main college building. The improvement in that quarter is marked, but still more is needed, and there have been no funds available for the other work recommended in the last Report. Much new wood-work ought to be done in the main building and its entire interior should be re-painted. This building is over thirty years old, and while in some respects it is as good as new, the methods of science teaching have entirely changed during this period, and considerable alterations are necessary to meet the present requirements of the work.

A better plan would be the erection of a new Science Hall, directly north of the college building, to contain suitable laboratories and lecture rooms for the departments of chemistry, physics, geology, botany and zoology. A large assembly room for general lectures and public occasions should also be included.

But whether anything else is done or not, some plan must be devised and executed soon, for giving better accommodations to the chemical department, else the work of the laboratory will become very unsatisfactory. The present quarters for chemical work are in an outbuilding never intended for such use, and are crowded and inconvenient; for purposes of instruction alone this building should be enlarged and remodeled, if not abandoned for something better. But in this building the important analyses under the Fertilizer Law are necessarily made, and for accuracy and value, this work requires plenty of room and special accommodations. This is a matter in which the farmers of the whole State are concerned, and it should receive immediate attention and remedial action.

Attention is called to the desirability of a central steam-plant and the other improvements recommended in the last published Report.

THE COLLEGE FARM.

Slowly, of necessity, but in a substantial manner, the arable land is being improved, and beginning to have a better appearance. For three years more attention has been given to getting that portion of the farm not used for experiment purposes, into an orderly and business-like condition, than to the production of profitable crops. The products have increased, however, at the same time. All the vegetables and most of the fruit needed by the College are grown on the farm, and all the long-forage and a good share of the grain, required for home uses. More is done each year than the one before, towards supplying the college demands for meat and dairy products.

The figures regarding the Farm, which appear in the Treasurer's Report, may be misunderstood. Only the cash items are there included. In the full Farm account, other credits appear to the amount of several hundred dollars for products consumed at the college. As appears by statement on page 13, the college funds were only drawn upon for \$204.79 on account of the Farm. Besides this, forage, etc. accumulated, so that the College Farm really just about paid expenses for the year.

The regular operations of the stable, the garden and the field, are varied and extended, with a view to affording a wider range of practical illustrations, to supplement the section-room work of the classes in agriculture and horticulture.

The equipment of the farm, in live-stock, tools and implements, vines, fruit trees and nursery-stock, is being rapidly improved, both for practical operations and for purposes of instruction. The chief immediate needs of the college farm are new fences, draining and repairs and additions to the buildings,—all requiring cash outlay. Then we need lime and manure, and time and patience, to accomplish the land-improvement desired.

THE EXPERIMENT STATION.

Organized in accordance with the law creating it, as a Department of the College,—located upon the College estate, governed by the same Board of Trustees and under the same executive officer,—the Experiment Station has its specially assigned land

and buildings and its own equipment, as well as its special income, and thus has an almost independent existence.

The First Annual Report was for the year 1888, and described the history, establishment and work of the Station, during that period. The Second Annual Report, for 1889, gave an account of the further organization and equipment and the commencement of its active operations. The Third Annual Report is submitted herewith, and records the operations of the year 1890, and the progress of this department of experiment and research. The present organization of the Station and the financial statement already mentioned, will be found in connection with the report.

The province of the Agricultural Experiment Station is clearly defined by the law creating it. It is not to be a "Model Farm," as contemplated by the original college charter,—nor even a "practical" farm, conducted for financial profit,—and while it incidentally grows grass and grain, and produces vegetables and fruits, milk and meat, the one crop to which it specially aims, is *information*,—or, as called for by the law,—“useful and practical information on subjects connected with agriculture.”

While the Station is constantly and increasingly useful to the College and its students, in affording object lessons and illustrating both the theory and practice, its legitimate pupilage is comprised of the adult farmers and gardeners of the State. The Station endeavors to reach the latter, through its frequent publications and by means of exhibitions and public meetings.

EXTENSION OF THE COLLEGE WORK.

The original charter, granted in 1856, declared its purpose to be the establishment of an Agricultural College, “in which the student may especially be instructed in those arts and sciences indispensable to successful agricultural pursuits.” Later laws, under which the College receives much the greater part of its income, and which have been either enacted by the State or assented to by it, broaden the scope of the institution, and make it not only possible but even mandatory, for the College, to extend its work beyond its class-rooms, laboratories and farm, and enlist its energies in any way to advance the material welfare of the agricultural interests of the State, if not other industries of the

people. With the means now at its command, and the opportunity thus given for development, it seems desirable to devise some method for the College to apply itself usefully in the different districts of the State. Courses of lectures, longer or shorter, might be conducted at suitable points, with a view to conveying "useful agricultural information" to those who desired to attend. Such lectures might be accompanied by small exhibitions of material, in the nature of object lessons, to illustrate and impress the facts given by the lecturers. Such a proceeding would be a fair substitute for the "Farmers' Institutes," so popular and so useful, in other States. If this is deemed too much of an undertaking for this institution alone, it might at least join local agricultural organizations in holding such meetings. There seems to be no good reason why the College proper should not enter so promising a field for usefulness, as well as its experiment department alone. A few attempts at work of this kind, indicate that a fixed purpose and systematic effort would be productive of good results.

Other institutions and agencies, with means and willingness to labor for the material interests of the State, might be joined in co-operative effort. The Johns Hopkins University has already shown a desire to thus co-operate. One piece of public work which has been proposed, is the completion of a Geological Map of Maryland, for which much data is already available. The surface geology and the soils of the State are so closely related, that a geological map could be easily followed by an Agricultural Survey and a Soil Map, which would be of great interest and value.

PUBLIC INTEREST IN THE COLLEGE.

Established and maintained as a State Institution,—for "the people,"—with its benefits free to all, and intended to be popular,—the educational department at the College must depend largely for its usefulness upon public interest and patronage. Anything should be welcomed, therefore, which tends to make its work better known to the people of the State and to enlist their interest. Public meetings, exhibitions and other work, as already suggested,—and some of which have been already tried by the Experiment Station with evident success, may well be used for this purpose. They are legitimate and efficient methods of advertising.

A very marked change in public sentiment, towards the College, in all its parts, has been manifested during the last few years. One evidence of this is the interest shown by the various agricultural organizations. The State Farmers' Association, the State Grange and the State Farmers' Alliance, have each established standing committees, to visit the institution, inspect and criticize its work and progress and report to their respective organizations. These committees, and others from farmers' clubs, local granges, alliances and other bodies, now frequently visit the College and Station.

At a recent annual convention of one of these State organizations, the presiding officer in his formal address, referred to the institution as follows:—"I would again call your attention to the Agricultural College and Experiment Station and commend it anew to your consideration and support. * * The large majority of the students are from the country, farmers' sons, who will, in all probability, bring their learning back with them to the farm, and help build up and support our agricultural interests. In my judgment the Institution is admirably officered and is doing good work for our cause and it ought to have the hearty co-operation of the whole farming community." From the report of the Standing Committee, presented at the same meeting, the following extracts, are quoted:—"During the past year (1890) we have, individually, and as a body, made visits to the College and Station and kept ourselves acquainted with the course pursued by the Board of Management and the general internal condition of affairs. * * * Greater facilities for practice and instruction in laboratory work are much needed. * * (In the chemical department) so much space and time are taken up in making the fertilizer analyses required by the new State law, that either the College instruction or State work has to be partly neglected. This should not be. Larger and better accommodations should at once be supplied. * * The general appearance of the College buildings has greatly improved, showing much care and attention devoted to these items. * * Many valuable charts and facilities for study have been added since last year. * * One thing your Committee was particularly glad to learn during their last visit to the College, was the complete harmony seeming to prevail among professors and students. Not a ripple has marred the smooth surface of College affairs, during this last session. * * * In closing this report we would urge upon the members, the importance to them of this Institution and their responsibility for its success. This will be assured if we give it a loyal support. * *"

If interest and assistance of this character can be first *deserved*, and then be secured and extended, it cannot fail to be of great value to the College.

RECOMMENDATIONS.

Incorporated in the foregoing report, are several recommendations, which are now summarized as follows:—

1. That the whole of the first annuity (\$15,000) under the New Morrill Act, be expended for facilities for instruction, as fast as is consistent with the judicious selection and purchase of College equipment.

2. That payments on the debt be reduced to a minimum, for some time to come, in order to make more funds available for alterations and improvements of the college buildings.

3. That the chemical laboratory be enlarged and refitted, with especial reference to accommodating the fertilizer work required by law, for the benefit of the farmers of the State. And that alterations be made in the main building, to give more and better working room for classes.

4. That, as soon as means can be obtained, a Science Hall be erected to suitably provide for laboratory work in general.

5. That with the increased income, for current expenses, the present work of the College be first strengthened and then new lines developed, which will be in harmony with those already established.

6. That a generous policy towards the College Farm be pursued, to facilitate fencing, draining, repairs of buildings and land-improvement.

7. That the work of the College be extended to include unaided and co-operative efforts in disseminating agricultural information and in developing the material interests of the State in connection with its agriculture and allied industries.

Upon the following pages will be found not only the matters already noted as appended, but other information relating to the College, to which particular attention is invited.

Very respectfully submitted,

HENRY E. ALVORD,

January, 1891.

President of the College.

APPENDIX.

Report of the Department of Agriculture.

The instruction in this Department was conducted much as described in the last published Report, (for 1888 and 1889,) during the first half of the year 1890. In June last, by vote of the Board of Trustees, the President of the College was placed in charge of this department—and it has since been conducted by him, or under his supervision. The work of the several classes is as follows:—

The Freshmen receive instruction through the year, from Mr. A. I. Hayward, Agriculturist of the Experiment Station, in relation to the breeding of domestic live-stock. History of the different races of farm animals is first taught, including the origin, development, fixity, present characteristics and distribution, of the several breeds of horses, cattle, sheep and swine. Then follows instruction in the Principles of Breeding, the uses of Stock Records and Pedigrees, and the Care of Stock. Horses, mules, cattle of different breeds, sheep and swine, kept on the College Farm, are used for illustration, and greater variety for observation is obtained by visiting farms within reach, where specimens of other breeds can be seen.

During the Sophomore year, attention is concentrated upon the Vegetable Kingdom—and instruction in Botany and Horticulture is continuous, as reported by Professor Brunk.

Having received the necessary preparatory instruction in chemistry, physics and mineralogy, the student is ready, in the Junior year, to study Soils, with Professor Whitney. The Origin, Formation, Characteristics and Classification of Soils, is followed by instruction in their changes, management and improvement, with

the study of Fertility. During this year, the lower forms of animal life are studied, and instruction given in Entomology. Courses of special lectures on subjects related to agriculture are also given to the Junior Class.

The members of the Senior Class, have attended one or more of the County Fairs, at which they have made a study of the animals and farm products on exhibition. This class receives lectures throughout the year, by the president and professor of agriculture, upon Natural and Artificial Manures and their application, Dairy Farming, Principles and economic practice in Feeding and other agricultural specialties.

The Experiment Station connected with the College, and the practical operations of the College Farm, afford exceptionally good opportunities for observation and for illustrating the application of scientific principles. Material is being gradually collected to facilitate instruction in this Department, but more is needed, and a re-arrangement of class-rooms should be made, so that Agriculture alone,—or the Departments of Agriculture and Horticulture combined,—can be assigned special quarters.

Respectfully,

HENRY E. ALVORD,

December, 1890.

Professor of Agriculture.

Department of Botany and Horticulture.

MARYLAND AGRICULTURAL COLLEGE,

*January 3, 1891.**President Alvord:*

DEAR SIR:—At your request, I have the honor to submit my first report upon the college work in Botany and Horticulture and some of the needs of this Department.

This instruction is at present confined to the Sophomore class, and the subjects of Botany and Horticulture are carried on together. In Botany, beginning in the Fall Term, the student familiarizes himself with the outward and visible characteristics of such leaves, roots, flowers and fruits as are available, as a preparation for advanced work in botany and in practical Horticulture. In the Spring Term, the study of flowering plants is continued and every student is required to make analyses and drawings of about one hundred typical plants and to collect, preserve, mount and arrange, fifty plants, as an herbarium. Special study is made of certain prominent families of plants, as found in the neighborhood of the College. Habits of careful and accurate observation are inculcated and cultivated.

The course in Horticulture, begins in the Fall Term and extends through the year. The practical operations of propagation are taught in the Autumn, with the physiological reasons for the same. Also the general principles of Orcharding, including selection of soil, laying out orchards, selecting nursery stock, setting trees, culture, fertilization, pruning, mixing and applying fungicides and insecticides, and storage houses.

The Winter Term is given to Large Fruits:—this embraces a detailed study of the apple, pear, peach, apricot, nectarine, plum, cherry, quince and grape. The history of each is studied, with its development, propagation, culture, pruning and training, gathering and marketing,—and the best varieties for special purposes.

In the Spring Term, the class takes up Vegetable Growing. Cultivated vegetables are grouped in their botanical families and studied as thus closely related. All of the vegetables which can be grown in this State are treated of, with the best varieties and proper treatment of each,—gathering for home or market, preservation, fresh or otherwise, and how to raise, save and care for the seed.

Incidental subjects taught are:—construction and management of forcing houses and hot-beds, tools, composts, fertilizers, and the general management of a market garden.

During the year every student is required to perform the various practical operations of the garden and the orchard in their season. He has practical lessons in budding, grafting, pruning, training, transplanting, cross-fertilizing, care of nursery stock, planting different kinds of seeds and studying their germination, growth, and habits. This work is not required for the sake of the labor, but always in the nature of instruction. As soon as a student learns to perform one operation properly, he passes to another.

It is hoped that during another year, courses may be added in Vegetable Physiology and Pathology, Small Fruit Culture, and Forestry and Economic Botany.

Before the Department can be considered properly equipped for good work, a good deal must be added in the way of facilities. Two good-sized rooms should be set apart for laboratory and lecture room for this department alone, and with accommodations for a large amount of illustrative, working material, as well as something of a botanical museum. A green-house of moderate size, is also almost a necessity.

The relation between the Horticultural Department of the College and the Experiment Station is fortunate, as, to a great degree, the material and appliances of each serve for the other; the experiment work is constantly illustrative and beneficial to the student.

Very respectfully,

THOS. L. BRUNK,

Prof'r of Botany and Horticulture.

Department of Chemistry.

MARYLAND AGRICULTURAL COLLEGE,

December 26, 1890.

Pres. H. E. Alvord:

DEAR SIR:—I beg to submit herewith, a report of the character and progress of the work of the Chemical Department of this College for the year ending December 31, 1890.

The course pursued in this department has been, in general, like that of previous years.

The Sophomores take up this study at the beginning of the year, and for two terms "Remsen's Introduction to Chemistry" is used as a text-book. This embraces, chiefly, the non-metallic elements and their compounds, the study being supplemented and illustrated by experiments.

The rest of the chemical course,—with the exception of one term of the Junior year,—consists of practical work in the laboratory. The Sophomores, during their last term, analyze simple substances in solution. This is followed, in the Junior year, with qualitative and blow-pipe analyses and volumetric analyses.

The Summer term of the Junior year is occupied with organic chemistry, in the class-room. This field is so broad that only such parts are considered as are of most practical value.

The Seniors study quantitative analysis, the first term, including mineral compounds, silicates, etc. In the second term, fertilizers, feeding stuffs and dairy products are analyzed. The third term is given to organic chemistry, including analyses of water, urine and gaseous compounds.

The interest manifested in this department the past year has surpassed that of previous years; several of the students have spent nearly all of their spare time at work in the laboratory.

The great need of the Department is a more modern building in which to do its work; this becomes yearly more urgent, as classes increase and extend their labors.

The Analysis of Fertilizers under the laws of Maryland, has formed a prominent part of this department during this year. This work is pushed as rapidly as the very limited accommodations will permit. I have analyzed this year about one hundred different brands of fertilizers. This work is rapidly increasing and it occupies so important a place in the agriculture of the State, that it should have every provision made which is needed to ensure accuracy and expedition in the work.

Respectfully submitted,

J. D. HIRD,

Professor of Chemistry.

Department of Zoology and Comparative Anatomy.

MARYLAND AGRICULTURAL COLLEGE,

*December 20, 1890.**Mr. President :*

DEAR SIR:—In accordance with your request, I submit my report of the Department of Zoology and Comparative Anatomy.

The present Senior Class (Class of 1890) was instructed by my predecessor, in general Zoology, embracing a careful study of the types of animal life. Since last September, this class has been instructed in the microscopic study of the tissues and organs of the human body,—viz:—the brain and spinal cord, the muscles, bones, nerves, œsophagus and stomach.

The Junior Class ('91) had received instruction, before it came under my charge, in Geology, Physical Geography and Natural History. Since September a course of lectures has been given this class, upon the general laws of Biology. The lectures embraced the physiology and microscopic structure of the yeast plant, the moulds, the bacteria, and the simpler green plants, including the fern.

The Freshman Class began with me in September the study of Physical Geography, using as a text-book "The Eclectic Physical Geography," by Hinman. The topics considered thus far include the General Laws of Nature, the Solar System, Movements of the Earth, and the Composition, Weight, Heat, Moisture and Movements of the Atmosphere.

Attention is most respectfully called to the pressing need of refitting the laboratory of this Department and adding to its equipment. Water and gas should be provided and more light. More microscopes are needed, with numerous charts, models and other appliances, to enable us to keep our work abreast of the times.

Respectfully,

A. C. WIGHTMAN,

Professor of Zoology and Comp. Anatomy.

Department of Physics, with German and French.

AGRICULTURAL COLLEGE, MD.,

*December 23, 1890.**Major Henry E. Alford, President:*

DEAR SIR:—In accordance with instructions, I submit the following report of the work done during the present year, in those branches of instruction, of which I have charge:

The study of Physics is begun by the Junior class. They use Steele's Popular Physics, as a text-book. This work is elementary, but exceedingly clear in statement and well illustrated, and I find the book gives the student both interest and pleasure in the subject.

The Seniors, having completed the manual, receive a course of lectures accompanied by experiments. Of these they are required to take notes and submit them for critical examination, accompanied by well drawn figures. During the latter part of the year, the lectures continue but are accompanied by laboratory work, in which practical subjects are taught, such as photography, electro-mechanics, telegraphy and electro metallurgy.

The facilities for practical instruction in physics at this College, have not been very good heretofore, but additions to our appliances have lately been made, and there are assurances that more are coming, so that we shall soon have a satisfactory equipment for the work of the Department.

MODERN LANGUAGES.

The classes studying German and French during the year, have done very well. More interest has been shown than usual. The Freshmen use Ahn-Henn's French course, and the Juniors have Joyne's Otto's German course. The Seniors have read a large work by Stern, as well as some choice selections made from noted authors.

Respectfully yours,

WM. H. ZIMMERMAN,

Professor of Physics, and of German and French.

Department of English and Latin.

MD. AGR'L COLLEGE,

*December 23rd, 1890.**President Alvord :*

DEAR SIR:—In accordance with your circular of the 13th inst., I herewith submit my report of the condition of the department of instruction under my charge, during the year of 1890.

The Department embraces English, Latin, History, Civil Government and Political Economy.

WINTER TERM, 1890.

Senior Class—History of Civilization—3 hours a week. Political Economy, with weekly lectures—continued from Fall Term. The preparation of selected themes.

Junior Class—Logic—begun and continued throughout the term—3 hours a week. A course of historical reading—as directed. Periodic essays upon selected topics.

Sophomore Class—The History of English Literature, with parallel readings and essays upon the lives and works of famous authors. Ancient History—3 hours a week. Latin—Cæsar's Gallic Wars—continued from Fall term, with exercises in construction and Latin composition.

Freshman Class—Word and sentence analysis. Essays upon selected topics. History of Rome—3 hours a week. Latin Grammar, with exercises in translation and composition.

SPRING TERM, 1890.

Senior Class—The Constitution of the United States, with a course of twelve lectures. Preparation of essays and orations, and elocutionary drill upon the same, as preparation for graduating exercises.

Junior Class—Logic—finished—3 hours a week. Periodic essays upon selected topics. A course of historical reading—as directed.

Sophomore Class—The History of English Literature—completed—with parallel readings and essays. Ancient History—completed. Latin—Virgil—exercises in construction and composition. Review of Grammar.

Freshman Class—Word and sentence analysis, with a short history of the English language. History of Rome—completed. Latin—Grammar, with exercises in translation and composition.

FALL TERM, 1890.

Senior Class—History of the Constitution of the United States, with a course of twelve lectures.

Junior Class—Rhetoric, with periodic essays. Medieval History—3 hours a week. Latin—Virgil—continued from Spring term—exercises in construction.

Sophomore Class—History of English Literature, with parallel readings and essays. Ancient History—2 hours a week. Latin—Cæsar—exercises in construction and translation.

Freshman Class—Review of English Grammar. History of Rome—2 hours a week. Latin—Grammar begun, with exercises in translation and composition.

The changes in the order of work from the preceding year, have been made necessary by the extension of the Latin course into the Junior year, and the introduction of History as part of the work of every class.

Assistance in the department became necessary, and Professor Works entering upon duty in September last, has had charge of the duties of the Freshman class, as above stated, during the Fall Term.

There is evident need of providing for systematic instruction in elocution in connection with this department. While the work in English is believed to be such as to familiarize students with the constructive idioms and history of their mother tongue, and to furnish them with illustrations of the best usage of English, as exemplified in the works of the masters of the language, yet supplementary to this work, and for its practical application, a systematic course in elocution and vocal culture would prove most beneficial and advantageous. It is to be hoped that facilities for this important work may soon be provided. At present there is neither time nor opportunity for giving it adequate attention.

Respectfully yours,

R. H. ALVEY,

Professor of Language and Literature.

**Report of the Military Department, and the Department of
Mathematics, and Drawing.**

MARYLAND AGRICULTURAL COLLEGE,

December 22d, 1890.

To the President:

SIR:—In accordance with your instructions, I submit the following report of what has been done in the departments under my charge, during the year now closing.

MILITARY DEPARTMENT.

Four hours per week are allotted to practical instruction.

During the Fall Term, new students are instructed in squad drill and then assigned to the company. Therefore, in the Winter Term, which is first in the calendar year, all the students being then ready to drill together, are instructed in the manual of arms. During the Spring Term, the instruction is under arms, in platoon, company and skirmish drill, and in gallery target practice. In the Fall Term, the preparatory work with new students has to be taken up again.

The Senior and Junior classes recite once each week in the tactics of infantry, except in the Spring Term. A lecture on general military matters is given every week through the year.

It is requested that two pieces of artillery be procured from the War Department, for foot artillery drill.

MATHEMATICAL DEPARTMENT.

During the Winter Term, the Senior class, which has been previously prepared therefor, receives lectures on Elementary Engineering and the Principles of Construction. In the Spring Term, this class receives theoretical and practical instruction in the use of the level and in topography and the class completes the map begun in the Fall. The Fall Term work of the Senior class, (its first term of Senior year) is in theoretical and practical Surveying, with the use of the compass and transit. A survey of some portion of the college farm is usually taken as one practical exercise and a complete map of the same is begun, to be completed the following Spring.

The Junior class is instructed in Solid Geometry and part of Trigonometry in the Fall Term, finish Trigonometry and also

Mensuration in the Winter Term, and begin Surveying in the Spring Term, being then instructed in the use of the chain and the compass, with the platting to correspond.

The instruction of the Sophomore Class, in Algebra and Plane Geometry was given by me the early part of the year, but beginning with the Fall Term, that class passed into the hands of Professor Works, for its mathematical instruction. That officer also teaches Arithmetic and Algebra to the Freshman class.

DRAWING DEPARTMENT.

As already stated, the Seniors do the map-work and topographical drawing properly belonging to their work in Surveying.

The Junior Class receives instruction in Mechanical Drawing, from models, and in Linear Perspective.

The Sophomore class is instructed in Free-hand Drawing, first with books and then from models. Geometrical or Instrumental Drawing is begun with this class, preparing them for the work of the Junior year.

The Freshman class, receives instruction and practical exercises in book-keeping, instead of drawing, and this is in charge of Professor Works, the assistant in the Mathematical Department.

Respectfully,

A. B. SCOTT,

1st Lieut. Infantry, U. S. Army,

*Professor of Military Science and Tactics, and Acting Professor of
Mathematics and Drawing.*

REPORT OF THE COLLEGE TREASURER,

*From September 1, 1889 to August 31, 1890, inclusive.*JOHN D. HIRD, *Treasurer, pro tempore*, in account with THE MARYLAND AGRICULTURAL COLLEGE.

DR.	SOURCE OF RECEIPTS.	LEDGER PAGE.	AMOUNT.	NATURE OF EXPENSES.	LEDGER PAGE.	CR.
	Balance of cash from W. H. Soper, Tr.	48	\$ 61 46	Bills payable,—notes paid	149	\$4500 00
	Income on Land Scrip Fund.	148	6213 45	Old accounts, reduction of debt.	26	1639 57
	Static Donation, 1889-90.	148	6000 00	Interest and discount, (debt).	14	586 30
	Fees under Fertilizer Law.	146	1007 00	Repairs on buildings.	10	1834 93
	Bills payable—(borrowed).	149	3000 00	Advertising, Taxes and Insurance.	38	266 15
	Old accounts, collected.	26	20 27	General Expenses	21	815 18
	Farm, receipts cash sales.	30	37 48	Salaries.	104	5775 00
	Students, receipts from.	101	5220 36	Equipment, furnishings, etc.	24	1007 32
	Board, not students, ditto.	102	1837 39	Farm, cash outlay	30	1100 27
	Other sources.	46	114 28	Domestic Department, ditto.	4	5564 71
				Plank walk	32	150 00
				Sundries ; rebates to students, &c.	46	204 75
				Balance paid to J. R. Owens, Treas.	47 51	47 51
			\$23,511 69			\$23,511 69

We, the undersigned, duly appointed auditors for the corporation, do hereby certify that we have examined the books and accounts of Prof. J. D. HIRD, Treasurer pro tem. of the Maryland Agricultural College, for the fiscal year ending Aug. 31st, 1890 ; that we have found the same correct and showing receipts and disbursements as specified in the above exhibit and equal in amount, leaving no funds to be further accounted for by him ;—but a balance of cash of \$47.51 remains to be taken up by the treasurer for the fiscal year beginning September 1st, 1890.

Signed : ALLEN DODGE, } *Auditing Committee*
 Signed : CHAS. A. WELLS, } *Board of Trustees.*

I hereby certify, that the foregoing is a true transcript from the books of account of the Maryland Agricultural College, as made in December, 1890.

Signed : JOS. R. OWENS, *Registrar.*

BOARD OF TRUSTEES.

Members Ex-Officio under State Law.

HIS EXCELLENCY E. E. JACKSON, *Governor*,

PRESIDENT OF THE BOARD.

HON. WM. PINKNEY WHYTE, *Attorney General*.

HON. L. VICTOR BAUGHMAN, *Comptroller of the Treasury*.

HON. ROBERT F. BRATTAN, *President of the Senate*.

HON. JOHN HUBNER, *Speaker of the House of Delegates*.

HON. EDWIN H. BROWN, *State Treasurer*.

Members Elected by the Stockholders.

HON. J. CARROLL WALSH, Jerusalem Mills, Harford Co.

HON. WILMOT JOHNSON, Catonsville, Baltimore Co.

CHAS. B. CALVERT, Esq., Agricultural College, P. G. Co.

ROBERT A. DOBBIN, Esq., St. Denis, Baltimore Co.

ALLEN DODGE, Esq., Washington, D. C.

Members by Executive Appointment.

	Term Expires.
GEORGE R. WILLIS, Esq., 213 Courtland St., Baltimore.	1892
DR. CHAS. A. WELLS, Hyattsville, Prince George's Co.	1892
COL. F. CARROLL GOLDSBOROUGH, Easton, Talbot Co.	1894
DAVID SEIBERT, Esq., Clear Spring, Washington Co.	1894
JEREMIAH P. SILVER, Esq., Glenville, Harford Co.	1896
WILLIAM T. BIEDLER, Esq., Baltimore.	1896

FACULTY.

HENRY E. ALVORD, C. E.

President,
and Professor of Agriculture.

THOS. L. BRUNK, B. Sc.,

Professor of Botany and Horticulture.

ARTHUR C. WIGHTMAN, Ph. D.,

Professor of Zoology and Comparative Anatomy.

JOHN D. HIRD, A. M.

Professor of Chemistry.

RICHARD H. ALVEY, JR., A. B.

Professor of Language and Literature.

WM. H. ZIMMERMAN, A. M.

Professor of Physics,
and Acting Professor of German and French.

ALBERT B. SCOTT, 1st Lient, Infantry, U. S. Army,

Professor of Military Science and Tactics,
and Acting Professor of Mathematics and Drawing.

A. PEYTON WORKS,

Assistant Professor of Mathematics and English.

MILTON WHITNEY,

Instructor in Geology and Soil Physics.

JOS. R. OWENS, M. D.

Registrar and Treasurer,
Secretary of the Faculty.

Students Enrolled during the year of 1890.

Name.	Residence.
ALVEY, CHARLES.....	<i>Hagerstown, Washington Co.</i>
AMMEN, FRANCIS DUPONT.....	<i>Ammendale, Prince George's Co.</i>
AMMEN, ULYSSES GRANT.....	<i>Ammendale, Prince George's Co.</i>
ANNAN, DANIEL, jun.....	<i>Cumberland, Allegany Co.</i>
BESLEY, FRED. WILSON.....	<i>Ash Grove, Fairfax Co., Va.</i>
BEST, HEZEKIAH.....	<i>Obligation, Anne Arundel Co.</i>
BOWEN, RUFUS HAMILTON.....	<i>Townshend, Prince George's Co.</i>
BRANCH, CHARLES.....	<i>Ellicott City, Howard Co.</i>
BROOKS, JOHN DOSHER.....	<i>Brookland, Dist. Col.</i>
BROWN, ARTHUR SIDNEY.....	<i>Lakeland, Prince George's Co.</i>
CAIRNES, CHARLES WILLIAM.....	<i>Jarrettsville, Harford Co.</i>
CALVERT, GEORGE HENRY, jun....	<i>College Park, Prince George's Co.</i>
CALVERT, RICHARD CREAGH M....	<i>College Park, Prince George's Co.</i>
CASHELL, EDGAR HILL.....	<i>Redland, Montgomery Co.</i>
CHEW, FRANK.....	<i>Baltimore.</i>
CHILDS, NATHAN.	<i>Highland, Howard Co.</i>
CHURCH, EDGAR.....	<i>College Park, Prince George's Co.</i>
CONLEY, CHARLES HENRY.....	<i>Fairland, Montgomery Co.</i>
DACKENHAUSEN, ALEX'R VON.....	<i>Washington, D. C.</i>
EVERSFIELD, DONALD.....	<i>College Park, Prince George's Co.</i>
FISHER, JOHN GORDON.....	<i>Sykesville, Carroll Co.</i>
FOSS, ALLISON ARCHER.....	<i>Washington, D. C.</i>
FOSTER, EDWIN HUNTER.....	<i>Washington, D. C.</i>
FOXWELL, GILBERT MARSHALL....	<i>Laurel, Prince George's Co.</i>
GALLOWAY, HOWARD BURGESS....	<i>Baltimore.</i>
GAMBRILL, STEPHEN WARFIELD....	<i>Laurel, Prince George's Co.</i>
GAMBRILL, WILLIAM GORMAN....	<i>Laurel, Prince George's Co.</i>
GEORGE, JAMES BERNARD.....	<i>Freedom, Carroll Co.</i>
GOLDSBOROUGH, MATTHEW T., jun..	<i>Easton, Talbot Co.</i>
GRAFF, GUSTAVUS ZEWELL.....	<i>Derwood, Montgomery Co.</i>
GROVE, EUGENE ASHBY.....	<i>Lime Kiln, Frederick Co.</i>

Students Enrolled during the year of 1890—continued.

Name.	Residence.
HEDGES, SAMUEL EDWARD.....	<i>Cumberland, Allegany Co.</i>
HOBLITZELL, FRANK WEIDERMAN..	<i>Myersdale, Penn.</i>
HOLLOWAY, DONALD PERKINS.....	<i>Washington, D. C.</i>
HOLZAPFEL, H. HARRY.....	<i>Hagerstown, Washington Co.</i>
HOPKINS, EDWIN DEVALL.....	<i>Bristol, Anne Arundel Co.</i>
HOPKINS, FREDERICK O..	<i>Monroe, New Jersey.</i>
JACKSON, THOMAS LAMAR.....	<i>Burnt Mills, Montgomery Co.</i>
JANNEY, JOSEPH ELLIOTT.....	<i>Brighton, Montgomery Co.</i>
JOHNSON, EDWARD DARLINGTON...	<i>College Park, Prince George's Co.</i>
JUSTICE, JAMES.....	<i>Washington, D. C.</i>
KEECH, WILLIAM SCOTT, jun.....	<i>Towson, Baltimore Co.</i>
KEMP, DAVID CHESTER.....	<i>Frederick, Frederick Co.</i>
LANGLEY, JAMES CLARENCE.....	<i>Scotland, St. Mary's Co.</i>
LATIMER, JAMES BRAWNER.....	<i>Port Republic, Calvert Co.</i>
LATIMER, THOMAS EDWIN.....	<i>Baltimore.</i>
LAWSON, JOHN WILLIAM.....	<i>Urbana, Frederick Co.</i>
MANNING, CHARLES CHENEY.....	<i>Hagerstown, Washington Co.</i>
MANNING, JAMES RUSSELL.....	<i>Branchville, Prince George's Co.</i>
MCDONALD, THOMAS BENTON.....	<i>Potomac, Montgomery Co.</i>
NILES, EDWARD GRANT.....	<i>Washington, D. C.</i>
PENN, SU.....	<i>Seoul, Corea.</i>
PUE, RICHARD RIDGLEY.....	<i>Highland, Howard Co.</i>
RAY, JAMES ENOS, jun.....	<i>Washington, D. C.</i>
RUSSELL, ROBERT LEE.....	<i>Washington, D. C.</i>
SEIBERT, WALTER STEWART.....	<i>Clear Spring, Washington Co.</i>
SEMMES, RICHARD MIDDLETON.....	<i>Cumberland, Allegany Co.</i>
SHERMAN, HENRY CLAPP.....	<i>Ash Grove, Fairfax Co., Va.</i>
SILVER, DAVID H.....	<i>Glenville, Harford Co.</i>
SILVER, WILLIAM SCOTT.....	<i>Lapidum, Harford Co.</i>
SMITH, FREDERICK JOHN.....	<i>Washington, D. C.</i>
SOLES, CLARENCE ELDER.....	<i>McKeesport, Penn.</i>
SUDLER, MERVIN TUBMAN....	<i>Westover, Somerset Co.</i>

Students Enrolled during the year of 1890—concluded.

Names.	Residence.
TOWERS, ALBERT GAREY.....	<i>Denton, Caroline Co.</i>
TOWERS, LAWRENCE BARTON.....	<i>Denton, Caroline Co.</i>
VEITCH, FLETCHER PEARRE.....	<i>Laytonsville, Montgomery Co.</i>
VERNAY, ERNEST HAMPTON.....	<i>Sykesville, Carroll Co.</i>
WADE, JOHN HUBERT.....	<i>Boonsborough, Washington Co.</i>
WILLIAMS, FRANK RAYMOND.....	<i>Washington, D. C.</i>
WORTHINGTON, ARTHUR BRASHEAR.....	<i>Frederick, Frederick Co.</i>

SUMMARY, BY COUNTIES AND STATES.

Allegany	3
Anne Arundel	2
Baltimore	1
Calvert	1
Caroline.....	2
Carroll.....	3
Charles	1
Frederick.....	4
Harford	3
Howard	3
Montgomery.....	8
Prince George's.....	12
Somerset.....	1
St. Mary's.....	1
Talbot..	1
Washington	5
Baltimore City.	3

MARYLAND.....	54
DIST. COLUMBIA.....	10
VIRGINIA	2
PENNSYLVANIA.....	2
NEW JERSEY	1
COREA.....	1

Total..... 70

GRADUATES OF 1890.

RICHARD C. M. CALVERT, B. S.
WILLIAM SCOTT KEECH, JR., B. S.
CHARLES CHENEY MANNING, B. S.
EDWARD GRANT NILES, B. S.
ROBERT LEE RUSSELL, B. S.
CLARENCE ELDER SOLES, B. S.

PRIZE AWARDED.

The Agricultural Prize for 1890 was awarded to

ROBERT LEE RUSSELL,
OF WASHINGTON, D. C.

HONORABLE MENTION FOR SPECIAL PROFICIENCY AND MERIT IN MILITARY DUTIES
AND EXERCISES.

CLARENCE ELDER SOLES,
OF MCKEESPORT, PENN.,

*Has been reported to the War Department for honorable mention, and his name
will so appear in the next U. S. Army Register.*

COURSE OF STUDY.

FRESHMAN YEAR.

Agriculture.—History, breeding and care of farm stock.

Natural History.—Climatology and Physical Geography.

History.—Ancient and Modern.

English.—Analysis and construction of language.

French. } Begun and continued through the year.

Latin. } One of these is required, but not both.

Mathematics.—Arithmetic reviewed; Algebra.

Book-keeping.—Single Entry, with practice in business forms and farm accounts.

SOPHOMORE YEAR.

Horticulture.—Fruits and Vegetables; Physiology of Plants.

Natural History.—Botany and Mineralogy.

Chemistry.—Begun and continued throughout the year.

English.—History of language; Expression and Style.

French. } Second year of both.

Latin. } One of these is required.

Mathematics.—Algebra completed; Geometry.

Drawing.—Free-hand and Geometrical.

JUNIOR YEAR.

Agriculture.—Soils and Plant Growth.

Natural History.—Geology, Zoology and Entomology.

Chemistry.—Laboratory practice and Organic Chemistry.

Physics.—Mechanics and Physics through the year.

English.—English Literature, Logic and Rhetoric.

Latin.—Third year. } Optional studies; both may be taken on certain conditions.

German.—First year. }

Mathematics.—Trigonometry, Mensuration and Surveying.

Drawing.—Mechanical and Topographical.

SENIOR YEAR.

Agriculture.—Manures and Fertilizers; Forage and Feeding; Dairying; Farm Mechanics; Lectures and Field Notes.

Chemistry.—Laboratory Practice; Organic Analyses.

Physics.—Lectures, with notes and examinations.

English.—Mental and Moral Science; Elocution; Debates.

History.—History of Government; Political Economy.

Latin.—Fourth year. } Optional Studies; both may be taken under certain conditions.

German.—Second year. }

Mathematics.—Practice in Surveying, Road-work and Elements of Civil Engineering, Principles of Construction, &c.

Drawing.—Map work; Projections and Perspective.

Lectures.—On Comparative Anatomy, Veterinary Science and Practice, and other topics.

Military Drill, as required by law, throughout the course.

Exercises in Composition and Elocution, as directed.

THIRD
ANNUAL REPORT
OF THE
MARYLAND AGRICULTURAL
EXPERIMENT STATION,
AT THE
AGRICULTURAL COLLEGE,
COLLEGE PARK,
PRINCE GEORGE'S CO., MARYLAND.
1890.

ORGANIZATION
OF THE
Maryland Agricultural Experiment Station.

CORPORATION:

The BOARD OF TRUSTEES of the MARYLAND AGRICULTURAL COLLEGE.

Agricultural (Station) Committee of the Board of Trustees:

Ex-officio, Hon. E. E. JACKSON, Governor, *President of the Board*.

Messrs. GOLDSBOROUGH, SEIBERT, SILVER, BRATTAN and BIEDLER.

OFFICERS AND STAFF:

HENRY E. ALVORD, C. E., *Director*.

HARRY J. PATTERSON, B. S., *Chemist*.

ALBERT I. HAYWARD, B. S., *Agriculturist*.

* WM. H. BISHOP, B. S., *Horticulturist*.

† THOS. L. BRUNK, B. S., *Horticulturist*.

ERNEST H. BRINKLEY, *Machinist*.

DAVID B. PERRY, *Stenographer*.

JOS. R. OWENS, M. D., *Treasurer*.

* Resigned, August, 1890.

† Appointed, September, 1890.

LOCATION.


On the Estate of the MARYLAND AGRICULTURAL COLLEGE, in Prince George's County, eight miles north from the City of Washington.

RAILROAD STATION, for Passengers and Freight: COLLEGE STATION, MD.
(On the Baltimore & Ohio R. R.)

P. O.—COLLEGE PARK, Prince George's Co., Maryland.

TELEGRAPH ADDRESS.—COLLEGE, MD. (Western Union Tel. Co.)

EXPRESS OFFICE.—COLLEGE STATION, MD. (United States Express Co.)

 *Address, in all cases—*

MD. AGR'L EXPERIMENT STATION.

THIRD ANNUAL REPORT

OF THE

MARYLAND AGRICULTURAL EXPERIMENT STATION,

FOR THE YEAR 1890.

REPORT OF THE DIRECTOR.

THE SEASON.—Where the operations of an Agricultural Experiment Station include field-work of any extent, the success depends very much upon the weather. The “full and detailed report” for the year should therefore include as complete an exhibit as possible of the climatic conditions under which the work of the Station has been conducted.

The season of 1890 has more nearly approached the normal conditions of this locality and has been more favorable to field operations and plant-growth, than either of those described in the previous reports of this Station. Yet it has had some peculiarities and some unfavorable features. The general facts are shown by the following table of annual averages:

PLACE OF RECORD.	TEMPERATURE. RAINFALL, INCLUDING SNOW.				
	Normal Mean.	Mean of 1890.	Normal, inches.	In 1890, inches.	Rainy Days, No. in 1890.
College Park, Md.	?	55.8	?	36.29	151
Baltimore, Md.	53.1	56.6	44.34	46.96	155
Washington, D. C.	54.8	56.3	44.44	41.59	151
Cumberland, Md.	51.8	55.8	33.19	50.63	118

Detailed records of the observations at this Station (recorded as College Park) are given in tables upon later pages. The records for comparison, from Washington, Baltimore and Cumberland, have been obtained through the courtesy of the U. S. Weather Service.

It will be noticed that the average temperature for the past year, at all the places reported, was somewhat above the normal or average for a series of years. This resulted from a mild winter, as the records of the growing season were very nearly normal. March was the exceptionally cold month of the year, colder at the Station than at Baltimore and Washington, and nearly all fruit was then destroyed. At this Station the month of June was a little warmer than usual and July was somewhat cooler.

The record of rainfall shows variations and peculiarities such as often occur. At Washington and at this Station, the yearly precipitation was below the average, while at Baltimore there was some excess, and much more at Cumberland. The deficiency in rainfall at this Station was decided, and had marked effect. With the same number of "rainy days" recorded, as at Washington (but eight miles distant), more than five inches less rain fell at the Station. Referring to the monthly records, the rainfall of March and April, and of August and September, was about normal, May was somewhat in excess and the deficiency occurred in June and July. There was but one good wetting rainfall in each of these months. In June the Station had about one-third its normal allowance, and only half as much as Baltimore and five-eighths of what fell at Washington. In July the Station rainfall was half the usual quantity and only two-thirds of what was recorded at Baltimore and Washington.

The results will be easily understood. The crops of early hay and of small grain, except late oats, were pretty good. But oats failed, if not exceptionally early, second crops of grass and clover were cut off, and the young grass of previous Fall and Spring seeding was destroyed. Corn suffered, as did potatoes, garden vegetables and such fruits as had escaped the destruction of the late frosts. Yet, as a whole, it was a particularly good year for regular and satisfactory working of the soil.

STRAWBERRIES.—This popular fruit is so extensively grown in several counties in the State as to form one of the most important and profitable crops. Unfortunately the statistics of this interest are not now available, but when they become known, the aggregate income to the farmers of Maryland, from this single fruit, will be surprising. The strawberry rightly commands attention at this Station. New varieties are brought into notice annually, by the score, and a person who seeks to increase or change his plantings is greatly puzzled in making selections. Growers naturally seek information on numerous

points of practical importance to them. Among the questions asked are these: What variety will give the greatest product per acre? Which is firmest and best for shipping to distant markets? Which gives the earliest crop? Which the latest? Which has the best color, flavor or other market qualities? What fertilizers can be most economically used to improve the quantity or quality of the crop? What are the cheapest and best methods of cultivation and propagation? How do varieties differ as to "holding their own" and "running out?" Which are most resistant and which most susceptible to disease? Some of these questions the grower must ultimately determine for himself, on his own farm, because they depend upon local conditions. But most of the points thus indicated can be investigated at this Station as well as anywhere, and upon all of them more or less light can be thrown by careful work. To this subject the Station will therefore give much attention. Specimen plants are obtained for testing as fast as they appear, and as far as possible they are got from the originators. Something has already been done in comparing varieties, as recorded in Bulletin No. 8, of June, 1890, and notes on the health of different varieties are given in the Horticultural section of this Report. There are now 125 varieties of Strawberries growing at this Station, most of which will fruit in 1891. The work will be increased and varied in future seasons.

WHEAT.—In nearly all parts of the State one of the staples is wheat, depended upon largely as a money crop. But the low prices prevailing for some years, combined with a somewhat decreased average product per acre, has made wheat an unsatisfactory and unprofitable crop. Varieties which have been in favor for years, have lately appeared to be losing ground and a general inquiry has arisen for a new or better wheat for Maryland. Although this Station has not particularly good wheat soil, it is able to grow an average crop, and it is now annually testing a number of varieties which have done well elsewhere and comparing their merits and suitability for this State. Forty varieties were harvested in 1889 and the results recorded in the Second Annual Report, p. 123. The past season, forty-five varieties or separate lots were harvested and compared, and the record published in Bulletin No. 10, of September, 1890. At the present time 84 varieties of wheat are growing on the Station grounds for comparison in 1891. Thus far, the Dietz wheat, or Dietz-Longberry, which originated in Pennsylvania, has done better than any other variety at this

Station, and during the past Autumn about eighty bushels of this grain were sent to different parts of the State for trial and report the coming year. Some work has also been done with different fertilizers applied to wheat, as described in the Bulletin mentioned, and this will be continued until more definite results are obtained.

TOMATOES.—A very large share of the work of the Station, the past year, has been the study of the Tomato. The record of what has been done is given in the Second Annual Report for 1889, pages 18 to 79, and in Bulletin No. 11, of December, 1890. Attention may be especially called to the advantages of potted plants, as shown in the bulletin named. Also, to the great gain in product from proper selection of varieties, based upon careful comparison. The average product per acre for 80 varieties tested in 1890, was $11\frac{3}{4}$ tons or 390 bushels, while the best ten varieties gave an average crop of 18 tons, and the very best one, the Ignotum, produced nearly 20 tons or 660 bushels per acre. The tomato interests continue to be extensive in this State and the good results are promised from further study of this subject.

TOBACCO.—This crop offers a good field for experimental study. Circumstances have made it inexpedient to undertake this work, however, the present year. Numerous important factors enter into the problem and it is essential to make careful preparation and secure competent expert assistance. Arrangements are in progress for making tobacco one of the leading features of the work of this Station during the season of 1891.

FEEDING EXPERIMENTS.—An increase in the animal industry of Maryland should be encouraged. There is good reason to expect profitable results in the near future from the judicious breeding and feeding of domestic animals. Economic feeding is one of the important farm problems of the present day, which is being widely studied. This Station hopes to participate in this work and now has facilities for undertaking some of its branches. Feeding experiments with swine and with young steers, have been conducted during the past year and the results, in part, will be given in the next Bulletin to be issued by the Station.

FORAGE CROPS.—Closely connected with profitable feeding, is the successful raising of the best crops for forage. Although this word rightly includes all food for farm stock, it is generally limited in its

application on the farm, so as to exclude seeds and grain, but include all other parts of plants eaten by animals. Under this head the Station continues its testing and comparison of grasses, clovers, the corn-plant, roots and other plants widely known and used. The following report of the Agriculturist includes the notes on this subject: Indian corn, the great agricultural plant of America, is receiving much attention, but deserves still more; one Bulletin (No. 3) has already been issued on this subject and others are proposed. Among the newer plants under trial here, are the Italian, or Crimson Clover, the Japan Clover, the "Unknown" variety of the Cow-Pea and the Soja Bean (Japanese). All of these promise to be valuable under certain conditions, in different parts of the State. They will be made the subject later, of special reports.

ENSILAGE.—The best method of preserving forage and the comparative value of the same plant, harvested and stored in different ways, form part of the general problem of forage and feeding. The system of silos and ensilage, is no longer an experiment. Practical farmers and dairymen in all parts of the country have demonstrated the direct profit and the incidental advantages of preserving a portion of their forage crops in the form of ensilage, so as to give their animals, of all kinds, a fair proportion of succulent food, throughout the year. Ensilage is found as profitable for supplementing pasturage in times of drought, as for giving stock "a green bite" in the winter. Indian corn is the favorite crop for ensilage, the most productive, the easiest to raise, and, all considered, the best. But clovers, the cow-pea and the soja bean, make a more nutritious article of ensilage, and may be advantageously mixed with corn, in the silo. Other plants and waste products, some unpalatable in other forms, make fairly good ensilage. Ensilage is no better food for stock than good roots, but in nine cases out of ten, ensilage can be produced and handled easier and cheaper than roots, and is just as good for stock-food. A good many points regarding silos and ensilage remain unknown or uncertain. Consequently ensilage of different plants is yearly made at the Station, managed in different ways, fed to different classes of stock, in various combinations, and the observations made are duly recorded. The annual reports of the Agriculturist give the experience with ensilage at this Station to date, and the subject will continue to receive proper attention.

HORTICULTURE.—Besides the work on strawberries already referred, fruits in general and the vegetables of the farm and garden, have a

prominent place in the work of the Station. Some record of the scope of this department was made in Bulletins No. 4 and No. 5, issued in 1889, and in the last Annual Report. Further details appear in the appended report of the Station Horticulturist. It will be noted that the work of this department is being extended to include nursery interests and numerous interesting questions incidental thereto—and also the treatment of vineyards and a study of the grape.

PLANT DISEASES.—Provisions have recently been made for including the numerous, and apparently multiplying diseases of plants, in the work of the horticultural department of the Station. Some notes in this connection are embraced in the accompanying report of the Horticulturist. It is evident that the Station may make its simple comparative tests of varieties of fruit, of practical value to growers, by pointing out those varieties which, under like conditions, prove most susceptible to the diseases prevalent among their respective species,—and which, on the contrary, appear to be the most hardy and healthy, as grown under the conditions usual in this State.

VARIETY TESTS.—The value of variety tests in general, as conducted at numerous Stations in this country, whether they be of grains, or grasses, or fruits, or vegetables, is a somewhat disputed question among the most experienced experimenters. It is certain, however, that these comparative tests are of popular interest and result in enough of good to warrant their continuance as a part of the work of the Station. They should be held within reasonable limits, however, and in publishing the records, care should be taken to warn the reader against placing too much reliance upon the results, and especially upon those of a single season. There are almost certain to be more or less local conditions which in part govern the results,—and while the records of these comparative tests of varieties may be properly valued as *suggestive*, the apparent lessons should be cautiously acted upon, and, as a rule, a home-test made, to verify the results under the changed conditions. For example,—the Deitz wheat, the Bubach and the Warfield strawberries and the Ignatum tomato, have done better than their rivals on the grounds of this Station, and for more than one season. But while, for this reason, the Station advises growers to try these,—it also recommends that others which have done well here, be also tried, but none of them too extensively the first season. Even if a single variety of wheat should stand first on the list in the tests of this Station for several successive years,—growers in other parts of the State, while urged to give it a trial,

would also be advised to try but a few acres at first and then in comparison with the best variety used in the vicinity. Upon the basis of the Station trials and records, the grower will certainly be able to select six, eight or ten varieties of wheat or of tomatoes, from one of which he may reasonably expect to get good results, and save the labor and expense of testing eighty to a hundred varieties, as necessary at the Station. Yet it should be added that difference in the local conditions *may* be such, that some wheat which, at this Station, has attracted no attention, *may* do better than any other, in Washington or Talbot, and for like reasons, one of the poorer tomatoes here, *might* prove to be the best in Harford or Wicomico. Variety testing has proved of sufficient interest and value, to be continued at the Maryland Station, and attention is invited to the records of such tests in the bulletins already mentioned and in the following reports of the Agriculturist and Horticulturist.

WORK OF VERIFICATION—POTATOES.—The view taken of this important branch of Station work, was given under this head in the last Report of the Director, (1889, p. 7) and need not be repeated. Again the effort has been made to verify the experimental results regarding the best form of potato for planting, by growing potatoes by the acre, under ordinary farm conditions, comparing the different forms of tuber for seed and with all the facts accurately observed and recorded. Although the early crop was a failure and the late one far from satisfactory, the comparative record was obtained, and this again substantially verifies the conclusions of former experiments. These field tests or verifications, prove that the most profitable form of seed for potato planting, in the average season, is the whole potato of egg size, in every hill, and that in some seasons, a much larger potato, uncut, is profitable. The details of this test are in the report of the Horticulturist.

At the same place will be found the record of another trial of the comparative productiveness—and hence the relative profit—of using for seed potatoes, tubers grown in Maryland, and others of the same parentage, so to speak, grown in Vermont. The result was much more decisive than in 1889; in every case, with the fourteen varieties tried, the Vermont seed gave more merchantable potatoes than the Maryland seed, and the gross product of the former was almost double that from the latter. In all, three times as many merchantable potatoes were grown from the Vermont seed as from an exactly equal quantity of Maryland seed. It seems safe to conclude, that one can-

not afford, in Eastern Maryland, to plant potatoes raised in the neighborhood, if two bushels of these will buy one bushel of Northern-grown seed potatoes.

SOIL TESTS.—Under this head there will be found in the appended Report of the Agriculturist, accounts of what some would call Fertilizer Experiments. They are preferably termed "Soil Tests with Fertilizers," because their main object is to learn what the soil, upon which the tests are made, most needs to give good results with the different crops tried. They are not a safe guide to conclusions as to the relative merits of different fertilizers applied on other soils. Hence the chief value of these tests, for the present, is to illustrate the methods by which, in any locality, soils may be tested to show what elements, forms or compounds of plant food, or fertilizers, are needed to give the best results. Incidentally, valuable information may be gained by this line of work at the Station, as to the special needs of various crops for different kinds, forms and quantities of fertilizers. And, by continuing these tests year after year, applying the same fertilizers upon the same plots, it may reasonably be expected that the effects will be intensified and the results become increasingly interesting.

During the past year these tests with fertilizers have been made with corn, wheat and tomatoes, one with fruit trees being also begun. Next year tobacco will be added, and it is intended to add to the variety of the incidental crops.

MARLS AND SOIL EXAMINATIONS.—Reference is made to the remarks under this head, in the Report of this Station for 1889, page 9, and to the record at pages 79 to 87, inclusive. The work has been continued as far as circumstances have permitted, and in the following report of the Station Chemist, are descriptions and analyses of fourteen specimens of Maryland marls examined during the year,—as well as of a few other deposits of muck and marsh mud, supposed to have fertilizing value. On the average, the marls examined the past year have not been as good as those handled the year before and none of those recorded in this report, contained as much potash or phosphoric acid as several in the last report. No marls have yet been found in Maryland and fully examined, which compare favorably with the "green sands" of New Jersey. But the work of location and examination of the marl deposits of Maryland has hardly begun.

The geological survey of the State, made by the Federal Government, is making reasonable progress, although in a rather disjointed

way. The time has nearly arrived when there should be joined to this an agricultural survey, or examination of the soils. A peculiarly intimate relation exists in Maryland between its geology proper, its surface geology and its agricultural soils. This fact, and work already done, warrants an effort to institute, at an early day, a systematic study of the soils of the State, with a view to their classification, description, defining the boundaries of the typical formations and explaining local variations. Arrangements are now making, by which this Station hopes to soon become a party to such an effort. As preliminary thereto, the Maryland Agricultural College and this Station, have already begun the compilation of a geological map of Maryland, which is needed as a basis for future operations. The U. S. Geological Survey and the Johns Hopkins University are cordially co-operating, by supplying all the data which they have heretofore collected, and furnishing special facilities for prosecuting this work.

Co-OPERATION.—As explained in the last Annual Report, it seems to be wise policy on the part of the Agricultural Experiment Station in every State, to co-operate systematically with other institutions engaged in like work. Upon this principle, some of the operations of this Station the past year, have been as follows:—

1. Growing sugar beets of different varieties and with various fertilizers, as an adjunct to the sugar investigations of the U. S. Department of Agriculture. A brief report of this work occurs at a later page.

2. Raising mulberry trees of different kinds for the information and use of the Silk Section of the U. S. Department of Agriculture.

3. Participating in a co-operative test of corn growing, conducted by the Stations in seven different States. The record of the field-work at this Station in this connection, is given in the appended report of the Agriculturist, but a proper estimate of results can only be obtained when the records from all the Stations have been compiled and digested; this duty devolves upon the Texas Station.

4. Laboratory work in the study of chemical methods, in conjunction with the Stations of several other States. This is noted in the report of the Chemist.

5. A beginning in co-operative work with the U. S. Geological Survey and the Johns Hopkins University, already mentioned and which it is expected to materially extend, during the coming year.

METHODS OF INVESTIGATION.—The study of methods properly engages the attention of experimenters not only in co-operation, but

in their individual capacity. Great improvements are annually made in this way, in saving time and securing greater accuracy in the methods pursued in chemical investigations.

The Chemist of this Station has had more or less time for the individual study of laboratory methods, and this has been well employed. A partial result is recorded in the appended Report of the Chemist, under the title of "The Use of Animal Charcoal in the Determination of Fat in Feeding Stuffs." This report is, in itself, of interest mainly to analytical chemists, and especially agricultural chemists. But any farmer having a general interest in the work of this Station and others, should be gratified to see that Station workers exert themselves to perfect their own methods and thus make the results of their labors more reliable.

IMPROVEMENTS AT THE STATION.—During the past year comparatively little has been done in additions to the Station buildings, as most of the annual allowance for this purpose was needed to complete the stable building and paint it. This is now in good condition for work, but the need of more storage room is already felt, and it is proposed to add an extension next year, with work-rooms, sheds, and loft for storage.

In the main "Rossburg" building, a room has been well fitted up for the office of the Horticulturist and to use as a Botanical Laboratory.

Draining has been extended, so that all the section of land on which are the Rotation Plots, is now well tiled. A good deal more work is needed in land drainage in the experiment fields.

Some desirable additions have been made to the library.

The lapse of time and the incident labor have made the greatest changes at the Station this year. Buildings have been arranged and land has been cultivated and brought into better condition, so that all at the Station feel that the facilities for satisfactory work have been greatly improved.

FARM MECHANICS.—The purpose of this department was stated in the last Annual Report, and this had been followed, as far as opportunity allowed, as shown by the Report of the Machinist which is appended. The recommendations of that report deserve attention. With the limited allowance which the law provides for such purposes, it will hardly be possible for the Station to provide the building necessary for the proposed display and comparative test Station, for farm implements. If, however, the building can be provided, by a joint

effort of the implement manufacturers and dealers,—the Station can probably do the rest and make the enterprise interesting and instructive. Such a collective exhibit would be a valuable object lesson for the students of the Agricultural College, as well as for visitors generally.

EXHIBITIONS AND MEETINGS.—The display of products, material and charts, illustrating selected portions of the Station work, at the Autumn Shows of the several County Agricultural Societies, proves, upon further experience, to be one of the very best means of “diffusing * * useful information” among the farmers of the State. The exhibits made by the Station are always arranged in the nature of an object lesson, showing the results of experiments made. These are accompanied by printed explanations, where needed, and members of the Station staff, or students of the senior class at the College are always in attendance, to answer questions and make the work of the Station better known to the people. During the Autumn of 1890, such exhibits were made by this Station in the counties of Baltimore, Cecil, Frederick, Harford and Talbot.

The policy of participating in public meetings for the discussion of agricultural questions has also been found increasingly useful. Farmers’ clubs and local Granges have co-operated in organizing such meetings in places where they have not been held before. During the year, the Director and members of the Staff have attended and taken part in meetings held in thirteen different counties. In a few counties several meetings have occurred.

VISITORS.—The very best way in which to have the objects, facilities and operations of the Station made known to those for whose special benefit the institution is maintained, is to induce as many persons as possible to come here and see for themselves. Special effort is made to have it generally known that visitors are always welcome and will be given every possible attention. This is having its effect, and, as time passes, visitors are increasing in number. The next best thing to visits from the individual farmers of a neighborhood, is for them to appoint a committee to come, inspect the institution and its work and report on its return to a meeting of the local Alliance-Club or Grange, or an informal neighborhood gathering. Several committees or larger delegations from agricultural organizations, now frequently examine the Station and The Maryland State Farmers’ Association, the State Grange and the State Farmers’ Alliance have appointed standing committees within the year, to inspect the Station

and its work and report to their respective bodies upon its condition and management. A special committee of the House of Delegates also inspected the institution in February, 1890, and made a very favorable report, which was published in the Journal of the General Assembly.

PUBLICATIONS.—Under the law establishing and maintaining the Station the following named Reports and Bulletins have been published and distributed during the year of 1890:

The Second Annual Report, dated January, 1890, pages 1 to 163.

Bulletin No. 8, March.—Farm Manures; pp. 1–16.

Bulletin No. 9, June.—Strawberries; pp. 17–32.

Bulletin No. 10, September.—Wheat; pp. 33–46.

Bulletin No. 11, December.—Tomatoes; pp. 47–74.

Special Bulletins have also been issued, as follows:—

“B,” July,—“Potash and Paying Crops.”

“C,” October,—Commercial Fertilizers sold in this State.

Editions varying from four to eleven thousand of these publications have been distributed, mainly by mail to individuals desiring them. The Special Bulletins, which are irregular and infrequent, are not sent out of the State, as a rule, and are not prepared for binding with the others. Unfortunate circumstances have prevented Bulletins No. 7, and No. 8, from being generally distributed, at the time of this writing.

The law provides that the publications of the Station shall be sent through the mails free of postage, to all newspapers in the State and “to such individuals actually engaged in farming as may request the same.” This quoted restriction does not apply to the annual report. It is probable that for the present, this Station will be able to send its publications to all who ask for them.

The General Assembly of 1890, to which the Second Annual Report of the Station was referred by the Governor, in January last, authorized the publication of that Report by the State Printer, and provided for a large edition, a part of which should be distributed upon the order of the Senators and Delegates. This action was on some accounts very desirable and appropriate, but it resulted in embarrassing delay and had other disadvantages. The size of the pamphlet and arrangement of matter on the pages could not be controlled, and the Report, as issued, is not uniform with the other Station publications. The circumstances also compelled a break in the plan of continuous paging,—so the report for 1889, neither continues the paging

from the Bulletins of that year, nor begins the series for the year following. The present report, being published by the Station itself returns to the plan of uniformity and continuous paging, taking its place, in the latter respect, between Bulletins No. 11 and No. 12.

It is thus evident that to have a part of the Station publications issued by State Printer and a part otherwise, is decidedly objectionable. But it is still believed that it would be eminently proper for the State to provide for *all* the printing of the Station. As stated a year ago, the principle has been generally accepted that, as the Federal government provides all cost of obtaining and formulating the "useful and practical information" of the Station, and permits the free use of the mails for distribution, the State should assume the publication of all the reports and Bulletins. It is hoped that this subject may receive the favorable attention of the next General Assembly of the State.

CORRESPONDENCE.—The previous Reports of this Station have invited direct correspondence with citizens interested in the work. Numerous communications have been received, and to these attention is always given cheerfully and as promptly as possible. The range of subjects covered by this correspondence is very wide and full of interest. These letters, which are numbered by the hundred, show what the farmers in different parts of the State are thinking about, the special problems which engage their attention and the lines of work which most interest them. The correspondence thus serves to assist and guide in planning the operations of the Station.

THE STATION STAFF.—The first change in the scientific staff of the Station, since its organization, has occurred during the year. After two years of faithful and efficient service, as Horticulturist and senior assistant, Mr. Wm. H. Bishop resigned his position and was relieved in August, to enter upon more general agricultural duties in Mississippi. His successor, chosen in September, is Prof. Thos. L. Brunk, B. Sc., a graduate of the Agricultural Department of Cornell University and for the past three years in charge of the Department of Botany and Horticulture, at the Texas State Agricultural College and Experiment Station.

IN CONCLUSION.—I wish to repeat my acknowledgment of the cordial support received from the Board of Trustees,—the attentive and intelligent services of the officers of the Station, and the interest, kindly criticism and substantial encouragement shown by many farmers and land owners in all parts of the State.

HENRY E. ÄLVORD, *Director.*

REPORT OF THE AGRICULTURIST.

BY ALBERT I. HAYWARD, B. S.

I.—SOIL TEST WITH CORN.

This experiment is a repetition of the "Soil Test with corn," recorded in the Annual Report for 1889. The plots and fertilizers used on them for the two years were identical. The plots are one rod wide by ten rods long, making one-sixteenth of an acre in each, except plots 1 to 5, which are only five rods long, owing to a difference in quality of soil. Spaces of $3\frac{1}{2}$ feet were left between adjoining plots, for the more complete separation of fertilizers; this gave room for four rows of corn 3 feet 4 inches apart on each plot, and reduced the area to one-twentieth of an acre per plot.

The land is a sand loam, apparently quite uniform in quality, very nearly level, the length of the plots running east and west. It was plowed May 9th, and prepared by thoroughly harrowing. The fertilizers were applied immediately after harrowing. In all cases they were distributed by hand, care being taken to sow evenly over the whole plot. The fertilizers were harrowed in lightly and each plot separately.

The fertilizers applied were exactly the same as in 1889, in kind and quantity; and in most cases the packages from which the fertilizers were taken were those of the previous year. The quantity applied was not governed by the cost, but by the composition of the fertilizer; the differences in quality of the materials used made it necessary to apply different quantities to obtain equal amounts of the separate fertilizing elements. For example, in the case of nitrogen fertilizers, 200 lbs. per acre of Nitrate of Soda was taken as the standard and applied to Plot 2. Plot 3 received such an amount of Dried Blood, as by analysis contained *nitrogen* equal to that applied to Plot 2.

The seventeen whole plots were divided into two sections by a line running north and south. Plots 1 to 5, lying wholly in the western section, are really half plots. On May 10th, the easterly section was planted by hand with Hickory King corn, and the westerly section with Silver's Yellow Dent. Germination was uniformly good, a few missing hills were replanted, and the long growing season allowed full maturity. The "Iron Age" cultivator was used as often as deemed necessary during the summer, and the plots were hand hoed once, to cut off large weeds near the hills.

The corn was cut up and shocked September 29th, and stood in the shock until October 28th, when it was husked and the different parts weighed. The following table gives amounts of fertilizers, per acre, and yields calculated per acre, of sound corn, soft corn, and fodder.

Remarks: This being the second year of this experiment, the results are more apparent than in 1889. The deficiency of this soil in certain elements of plant food is becoming apparent; where this deficiency is well supplied, the land produces a good crop, but in an adjoining plot, the application of a second element of plant food shows no increase in yield over the single one particularly needed.

In making a comparison of yields, only the half plots in the first section are taken into consideration. The easterly half of plots 1 to 5 were not planted, as already stated, owing to a difference in quality of soil, and the half plots, 6 to 22, are excluded because the variety of corn used made an unsatisfactory growth.

In regard to the product of fodder we notice the uniformly large yields of those plots receiving Nitrogen, either alone or in combination. The average of plots 2, 3, 4, and 5, which received Nitrogen in different forms is 3125 lbs. dried fodder per acre. The yield of plots 6, 7, and 15, having Nitrogen in combination with either Phosphoric acid or Potash, or both, is 3250 lbs., a gain of 125 lbs. per acre over the special Nitrogen plots. Those plots receiving only Phosphoric acid, Nos. 8, 9, 10, 12, and 13, gave an average yield of 2445 lbs. per acre, while the Potash plots Nos. 14, 16, and 17, averaged 2666 lbs. per acre. To compare with the above, plots 1, 11, 21, and 22, received no fertilizer; these gave an average yield of 2473 lbs. per acre. The "nothing plots" thus did better than those which had phosphoric acid alone, and the excess of fodder on the potash plots over the nothing plots, averaged less than 200 lbs. per acre, a gain much less than the cost of the fertilizer.

The average of those plots receiving Nitrogen, either in combination or alone, shows an increased yield of 714 lbs. per acre, or 28.8 per cent. That this is due to the Nitrogen application is easily seen by comparing with those plots receiving Potash or Phosphoric acid.

Next consider the yield of grain per acre. The Nitrogen plots Nos. 2, 3, 4, and 5, returned a yield of 60.2 bushels, reckoned at 70 lbs. per bushel, while the four nothing plots Nos 1, 11, 21, and 22, averaged 40.8 bushels per acre. This is an increase of 19.4 bushels, or 47.5 per cent. Those plots receiving Nitrogen in combination with either Phosphoric acid or Potash, or both, show no increase of grain to correspond with the increased amount and cost of fertilizer applied. The average of plots 6, 7, and 15, is 56.6 bushels, which is a gain over the nothing plots of 38.8 per cent.; but this gain is not

equal to that of the plots receiving Nitrogen only; hence it may be supposed that the gain is almost entirely due to the Nitrogen. The average of the five plots receiving Phosphoric Acid in different forms, Nos. 8, 9, 10, 12 and 13, is 38.5 bushels, which is 2.3 bushels less than the yield of the nothing plots. If this average yield be compared with the nearest nothing plot, No. 11, an increase of nearly 5 bushels per acre is found; this is hardly a fair comparison, however, as No. 11 gave the smallest yield of any plot receiving no fertilizer. Those plots receiving Potash alone, Nos. 14, 16 and 17, made an average yield of 42.5 bushels, a slight increase over the nothing plots; also over the Phosphoric acid plots; but compared with No. 15, which, in addition to the Potash, received Nitrogen, a heavy balance is found against Potash fertilizers alone for corn.

Very little need be said in regard to plots 18, 19 and 20, receiving Marl, Lime and Land Plaster, respectively. There was no marked increase in grain from these applications, although the yields were a little above those of the nothing plots. But the Lime plot gave one of the best crops of fodder in the list.

Results:—a. The Nitrogen plots gave an increased yield as compared with those plots receiving no fertilizer, of over 19 bushels, while an equal money value application of Muriate of Potash (plot 15) gave less than 2 bushel increase; the cost, in the form of Nitrate of Soda (plot 2), was at the rate of \$4 per acre.

b. Phosphoric acid when applied alone failed in every case except one, to equal the average product of the nothing plots; the cost, in the form of Dissolved Bone Black, was \$6 per acre.

c. The application of Phosphoric acid, or Potash, or both, in addition to Nitrogen, in no case gave a profitable increase of product.

d. The largest yield of dried fodder was from Plot 7, receiving the "complete fertilizer," but in no case did a large yield of fodder follow the application of either Potash or Phosphoric acid alone. In every case where Nitrogen was used the yield was far above the average.

These results must not be accepted as applying to all soils. They give a good indication of the fertilizers or elements of plant food to which corn gives the quickest and most response; but, more particularly, they show what fertilizers are best for corn on the soil here tested. The soil on which this test was made is described at the

opening of this report, and soils varying from this would probably give different results. The soils of other and distant farms cannot be studied by this Station, but by a careful perusal of this and other tests, it is hoped that farmers may be encouraged to study and test the soil of their own farms in a similar way. This record will serve therefore as an illustration of a soil test with fertilizers, corn being the crop used for the test.

II.—CO-OPERATIVE CORN TEST.

In the Spring of 1890, Prof. Gulley, Director of the Texas Agricultural Experiment Station, planned an experiment to be carried on co-operatively by several stations. The object was to test and compare for both grain and fodder, in northern, central and southern States, approved varieties of corn grown in those different States. Accordingly, one variety of corn, successfully grown in each of the several co-operating States, was distributed from each, to all the others. The Maryland Station thus received one selected variety of seed corn from the Experiment Stations of New York (Cornell), Wisconsin, Kansas, Kentucky, Georgia and Texas; for Maryland an approved Harford county variety was used, and sent to the co-operating Stations.

For those varieties commonly grown in a warmer climate, distances were allowed of four feet between rows and two feet in the row, for field corn, and one foot in row for fodder corn. Those varieties accustomed to the latitude of Maryland, were planted in rows three feet nine inches apart, and twenty inches apart in the row for field culture, and nine inches for fodder. The smaller flint varieties from Wisconsin and New York were planted in rows three feet six inches apart by fifteen inches in the row for field, and six inches for fodder.

The varieties from the more northern States, failed to do well. Although their germination and early growth were good, very few perfect stalks could be found on the plots, and hardly a perfect ear. As soon as each variety reached maturity, an area of one square rod was cut, and the results are recorded in the accompanying table.

The varieties from Kentucky, Kansas and Maryland, being better adapted to this latitude, matured well and made a good growth, while the unusually long season permitted the fair development of the more Southern varieties. In an ordinary season, the varieties from Georgia and Texas would have been killed by frost before reaching maturity.

TABLE No. II.

Co-operative Corn Test; Yield per Plot and per Acre.

VARIETY FROM	PER SQUARE ROD—LBS.			CALCULATED PER ACRE—LBS.		
	Weight Green Fodder Corn.	Weight Dry Field Corn Fodder.	Weight Ears Field Corn.	Weight Green Fodder Corn.	Weight Dry Field Corn Fodder.	Weight Ears Field Corn.
New York. . . .	37½	7	5½	5,962	1,120	880
Wisconsin	73	10	15½	11,680	1,600	2,520
Maryland.	150	25½	33½	23,000	4,080	5,360
Kentucky	152	20	27½	23,320	3,200	4,360
Kansas	176	19½	32½	28,160	3,120	5,200
Georgia.	138	30½	22½	22,080	4,880	3,560
Texas	142	45	34	22,720	7,200	5,440

This is, of course, only one-seventh of the full record. Reports from the other States were made to Texas, and it is left to the Station of that State, whence the trial originated, to make the full report and discuss the results.

It will be noted, however, from this Table II, that the Texas corn gave a remarkable yield of field-cured fodder (if it was really cured), and that this was the only variety which produced as much grain as Silver's Yellow Dent, the Maryland selection.

III.—THE FORAGE GARDEN.

a. *Grasses.*

A detailed description of the various grasses growing in the forage garden was given in the Report for 1889, and it is therefore only necessary to mention again those which have given good results the past season.

The three Bent grasses, R. I. Bent, Red Top, Creeping Bent, made a very good growth. Red Top and Creeping Bent are very much alike, if not identical. These grew to a height of one and one-half to two feet, forming a close, compact, unbroken sod. Meadow fox tail, quite early, formed a good sod; it is better for pasture than

mowing. Sweet Vernal, a common, well established grass, is very early, but like the last, it is a pasture grass. The annual sweet vernal was a failure. Tall Oat, one of the most perfect plots, grew fully four feet in height, was in condition for cutting June 10th, and fully ripened soon after; this grass is recommended for use as part of a meadow mixture, but should not be sown with Timothy, as the latter is much later. Burmuda grass:—Probably owing to the very mild winter of 1889 and '90, this grass did not die out, but formed an excellent sod, even and compact, and reached a height of eight or ten inches. It is well adapted to grazing; in plowed lands its fault is in spreading into surrounding territory, where not wanted. Orchard grass and Timothy made excellent growth, and both are recommended for cultivation in this section. Johnson grass gave two fully matured crops; if it had been cut three times, one-third more weight would have been obtained and all of a much more palatable forage, as the stems are very coarse and hard when allowed to mature.

b. Clovers.

The standard clovers, Medium red, Giant red and Alsike, presented a good appearance early in the season. The Giant red is from one to two weeks later than the Medium clover; it has larger leaves and stems, and a more rank growth, generally. The hot and dry period in summer killed the Alsike and somewhat injured the others. Crimson clover sown in 1889 was bright and green through the entire winter; it started into growth very early in the spring, producing stalks a foot or fifteen inches high, each terminating in a head one to two inches long, of a beautiful crimson color. Being an annual, as soon as the seed matured, the plant died and the seed then dropped, germinated and grew, forming a plot superior to the old one, and with promise of abundant foliage early next season. No weights were taken, and the hay-producing qualities of the plant were not determined. More extended areas have been sown on the college farm, and it is hoped that data may be obtained on this point.

Lucerne or Alfalfa, which has given such good results in some sections of the country, has not been successfully grown here; under very good conditions it has given only moderate returns.

Japan clover, or *Lespedeza Striata*, was sown for summer pasture with very satisfactory results. With the intention of producing increased amounts of seed by early sowing, about two acres was sown February 28th, on an old pasture sod. An adjoining plot of about

the same area was sown March 20th. There seemed to be very little difference in the amount of pasturage obtained from these two plots, and no marked difference could be observed in the amount of seed produced. The long season favored the maturity of a much larger quantity of seed than in 1889. But although there appeared to be so little seed produced in 1889, a fair growth was obtained without additional seeding in 1890.

c. Forage Plants.

Unknown Pea. About fourteen acres were sown with the Unknown Pea, for plowing under as a green manure. The Peas were sown in rows 3 feet apart, and the plants about one foot apart in the row; a light rain with a hot dry period following, baked the surface so hard that less than one quarter of the plants succeeded in forcing their way through. Those which did come up, made a satisfactory growth, but the crop was small as a whole. A small crop of this Unknown Pea, in the grass garden, made a heavy crop and fully matured its seed before frost. This is the first seed that has matured at this Station.

Soja Bean. *Soja hispida*. For the past three seasons this valuable Japanese forage plant has been grown at this Station. In 1888 and 1889 the conditions were not favorable and only medium crops were secured. The land taken this year for the crop was a fairly uniform plot of nearly three acres, located east of the Station building. It was plowed in the Fall of 1889. On June 2d, it was thoroughly harrowed with a Clark's Cutaway Harrow. Being still rough and with many briars growing, it was plowed again, the next day. It was then harrowed with a Thomas smoothing harrow, which left the soil in very fine condition.

Twelve plots, 55 x 198 feet were laid off, side by side, and these were divided into equal sections by a line running through the entire series, from north to south. This gave 24 plots, each 55 by 99 ft., and containing one-eighth of an acre. Rows two and one-half feet apart were marked off across the plots. The seed beans were dropped with an Eclipse drill from one to two inches apart in the rows; no fertilizer was used.

The seed germinated well, and a uniform and continuous growth was obtained; no blight appeared as in 1888, the foliage being bright and vigorous until harvest. The best portions attained a height of fully three feet, and an average of two and one-fourth feet was made

over the entire field. The land was kept lightly cultivated all summer. When cut, September 16th, the plants were in full bloom. As there was no fertilizer applied, and the conditions under which the plots were cultivated were identical, the yield of the several plots is taken as an index to the quality of the soil and is used as a basis upon which to make subsequent experiments.

In order to harvest in one-eighth acre plots, it was necessary to cut the beans with a scythe. They could have been cut with a mowing machine, and in this way the harvesting would have been very rapid. The bean plants were cut into half-inch lengths, and put into a silo with alternate loads of corn.

YIELD OF SOJA BEAN, PER PLOT.

PLOT NUMBER	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11.	No. 12.
	Lbs.											
Sect. I.	2014	1570	1270	980	1094	1030	1440	1030	940	820	640	726
Sect. II.	1727	1060	1370	1060	1075	1434	1060	991	1033	780	654	654

The largest plot yield, at the rate of over 8 tons per acre, far exceeded any that has been secured heretofore at this Station. Taking into consideration the highly nitrogeous character of the plant, the feeding value of this crop of 8 tons per acre is equal to at least sixteen tons per acre of fodder corn. The total yield of the three acres as thus grown, was 13 tons. On good soil, with proper manuring, this plant would undoubtedly give a much larger yield.

IV.—VARIETY TEST OF WHEAT AND OATS.

A comparative test of 45 varieties of wheat, sown in 1889, was finished and the results published in Bulletin No. 10, September, 1890, of this Station. This trial was satisfactory in every respect, and the comparison is believed to be fair. A repetition of the test with about sixty additional varieties is now in progress.

A soil test with various fertilizers, using wheat as the testing crop, was made and reported in the Bulletin just mentioned. The set of 'fertilizer plots' where a soil test has been in progress for two years, and on which corn was grown in 1890, has been sown with wheat, the same system of fertilizing being continued.

A comparative test was also made with 40 varieties of oats. But the crop was a failure here as well as generally in the State. As

none of the varieties made a normal growth, no conclusions of value can be drawn from the test, and details are omitted.

V.—THE ROTATION PLOTS.

A description of the land, and the system of Rotation, is given in the 2d Annual Report of this Station. For convenience, the plan of manuring is here repeated. Each half acre plot is sub-divided crosswise into four sections. When in the course of rotation a plot is planted in corn,—Section I, will have a dressing of commercial fertilizer; Section II, will have an equal amount of plant food in the form of stable manure, and also at the time of bringing wheat into the rotation this section will have a dressing of commercial fertilizer; Section III will have the same amount of stable manure as Section II, but nothing else at any time; Section IV will have no fertilizing material except in the green sod turned under in the rotation. Thus, on the six rotation plots the effects of rotation will be observed, without fertilizer, with stable manure, with stable manure supplemented by commercial fertilizer and with commercial fertilizer alone.

The following is a record of the manure and fertilizer applied, and the crops obtained from the different plots and sections of plots, for the year 1890.

PLOT I.

A medium sod was plowed under in the Fall of 1889. In May, the plot was fertilized as follows:

Section I, 50 lbs. dissolved Bone Black; 25 lbs. Muriate Potash and 140 lbs. Dried Blood.

Section II, 2048 lbs. of stable manure.

Section III, 2035 lbs. of stable manure.

Section IV, Nothing.

The manure applied to Sections II and III, was of known composition, being made by animals inclosed in water-tight box stalls, and the quantity and chemical analysis of all foods consumed being known. The fertilizer applied to Section I equaled as nearly as possible the amount of plant food applied to Sections II and III. The fertilizers were thoroughly mixed with the soil by harrowing; rows were marked off 3 feet 9 inches apart, and Harford county corn was planted with the Eclipse Drill.

YIELD.	Section I.	Section II.	Section III.	Section IV.
Grain, lbs.	508	461	499	296
Top Fodder, lbs. . .	104	86	96	125
Blades, " " . . .	56	48	48	16
Butts, " " . . .	312	239	273	158

The largest yield, 58 bushels per acre, was obtained from Section I, having the commercial fertilizer, while the two sections receiving stable manure closely follow. The apparent increase of top fodder on Section IV, is due to some stalks having no ears and being cut rather lower than should have been done.

PLOT 2.

In grass and received no fertilizer.

YIELD.	Section I.	Section II.	Section III.	Section IV.
Field-cured Hay, lbs.,	44	60	54	52

PLOT 3.

In grass and received no fertilizer.

YIELD.	Section I.	Section II.	Section III.	Section IV.
Field-cured Hay, lbs.,	78	80	33	62

PLOT 4.

Sown in October, 1889 with Hybridized Fultz wheat. March 18, 1890, sowed 14 lbs. Orchard Grass seed on the plot. Section II, of this plot received a dressing of 75 lbs. S. C. Dis. Rock, and 15 lbs. Nitrate of Soda.

YIELD.	Section I.	Section II.	Section III.	Section IV.
Grain, lbs.	35	49	33	48 $\frac{1}{4}$
Straw and chaff. . . .	121	157	87	129

The effect of the fertilizer application on Section II, is noticeable as compared with Sections I and III, but Section IV was nearly equal in yield, although unmanured.

PLOT 5.

In grass, which had received no fertilizer.

YIELD.	Section I.	Section II.	Section III.	Section IV.
Hay, lbs.	110	62	64	108

In October, this plot was plowed and put in condition for wheat. Deitz wheat was sown October 3d, at the rate of 5 pecks per acre. Section II received 75 lbs. S. C. Dis. Rock, and will have 15 lbs. Nit. Soda applied as soon as growth begins in the Spring. Six lbs. of Orchard grass seed was sown with the wheat, and four lbs. Red clover seed will be added in the Spring.

PLOT 6.

This is really the first plot from which rotation results are obtainable. It was planted with corn in 1889, and then manured in the

same manner as plot I was in 1890. The effects of previous applications of manurial materials are noticeable. In following the plan of rotation, oats without fertilizer succeed corn. Accordingly this plot was prepared by plowing and harrowing, and on March 25th, it was sown with $1\frac{1}{2}$ bushels of Clydesdale oats, drilled in, and 4 lbs. of red clover seed were sown broadcast. The yield of the different sections is comparative though the crop was virtually a failure.

YIELD.	Section I.	Section II.	Section III.	Section IV.
Grain, lbs.	53 $\frac{3}{4}$	55	74	46 $\frac{1}{2}$
Straw and chaff. .	138	141	141	83 $\frac{1}{2}$

In this, the second crop, the stable manure shows favorably, though not increasing the crop to any marked degree.

SILOS AND ENSILAGE.

A complete record of the filling of the Station silos for 1889, is given in the 2d Annual Report, pages 100 to 105; also a report of the opening of Silo No. 3. Silo No. 2, filled with corn cut into half inch lengths, was opened the 4th of February. This silo showed a minimum amount of loss by decay, only $2\frac{1}{2}$ or 3 inches being found on top. The sides were spoiled somewhat deeper. Silo No. 1, which was only partly filled, with whole fodder and a covering one foot thick of soja beans, on top of which were boards and a weight, did not keep its ensilage as well as No. 2. Some of the corn and all of the bean silage, was decayed; this may be partly accounted for by exposure to the summer heat, as the silo was opened late in the season, to supplement pasturage.

Storing in 1890. Silo No. 2, and nine feet in Silo No. 3, were filled with a mixture of corn and soja bean, September 16th to 19th. These were covered with boards and weighted, as past experience indicates the economy of this practice. The cost of storing in the case of these two silos, was increased by unfavorable circumstances. The land for ensilage corn, which was near the silo, was so hardened by the short drought in June, that it was impossible to plow and fit it for the crop; consequently, land of a lighter character but further from the silo, was used for this purpose. This distance from the silo, the cutting by hand of the soja beans, and the breaking of a cutting machine, all tended to increase the cost of the work. Nevertheless, the silage was stored for about the same cost per ton as in 1889.

Silo No. 1 was filled October 20th, with fodder put in whole, carefully packed. The growth of corn was small and was easily handled. After filling it was weighted at 60 to 70 lbs. per square foot; this weight reduced the bulk nearly one half. The cost of storing was much less, but the labor of removing for feeding is greatly increased by this method.

Silo No. 3, filled with a mixture of corn and soja beans, was opened December 13th; the silage was in fair condition, an average of less than four inches of decayed material on top. A record of all waste is now being kept to find the proportion of loss, and also to compare with the different method of filling practiced in the case of Silo No 1.

VI.—MISCELLANEOUS.

Drains. A large part of the land West of the Baltimore and Washington turnpike, and directly South of the Station buildings, has been drained during the past season. The tile used was unglazed, two-inch channel, hexagonal in shape, and in thirteen inch lengths. The drains all open into the ditch beside the highway, so the outlets can be watched. Drains are laid thirty feet apart, at a depth of two feet to thirty inches, with a fall of at least two and one half inches per rod, and most of the distance it was four to five inches. The drains were located and graded with a level, and care was taken to have a uniform bed for the tile to lie upon. In laying the tile, joints were made to fit together closely; this is done by turning the piece until the best joint obtainable is made. The joints are covered with strips of tarred paper, to prevent fine soil and silt from getting into the pipe, and then a shovelful of earth is thrown over the joint to keep all in place. The rest of the work of filling the trenches was done with a mule and road scoop-shovel.

It is hoped to finish draining the Rotation Plots in the manner described, before spring work begins. This will make between four and five acres thoroughly underdrained. The work is all carefully done and should result in much permanent improvement to the field. The beneficial effects are already quite apparent on the part thus drained a year ago.

The Symmes Hay Cap. This hay cap is made of pasteboard or wood-pulp covered with some water-proof dressing; it is shaped like a saucer, with a diameter of 58 inches, and the edge is corrugated. This cap has been used for two seasons past, for preserving hay and

grain while in the shock. The objections are the cost, fifty cents per cap, and the difficulty of securing to the shock. Brass eyelets are provided through which wire hooks can be put, but this involves more time than is usually available before a sudden summer shower. Where small quantities of grain are to be kept in the field some time, as in the case of our variety tests of oats or wheat, the caps are of great value, effectually keeping out water and perfectly preserving the grain and straw. For a test, a few shocks of grain were covered in July, 1889, and remained in the field until February 22d, 1890, when the straw and grain were found to be as well preserved and as bright, as if kept in a barn. In this case the caps were secured in place by strings from the eyelets, attached to stakes at the bottoms of of the shocks.

A. I. H.

REPORT OF THE HORTICULTURIST.

BY THOS. L. BRUNK, B. S.

The present Horticulturist of this Station took charge of the department on the 8th of October last, consequently a report for the past year must be largely upon the work of Prof. W. H. Bishop, who resigned his position as Horticulturist, in September. Some observations will be added, however, which may be of interest to the grower, together with a partial outline of future work.

It has been the policy of the Station to undertake experiments on crops that are widely cultivated in Maryland, in order to be of interest and benefit to the greatest number of farmers and gardeners. Considerable work has accordingly been done, by this department, during the last three years, on questions concerning the Tomato, the Strawberry and the Potato. These three crops, together with the Peach, represent the leading horticultural interests of the State.

I.—TOMATOES.

The same variety tests and fertilizer tests made during the year 1889, and described in the Second Annual Report of this Station, were repeated the past year, and the results being published in Bulletin No. 11, need not be repeated here. These experiments, with some modifications, will be continued the coming season and probably through a series of years, to obtain average results. The work of a single season by itself has comparatively little value. Many observations have already been made which may prove valuable in the improvement of the tomato and in determining the best fertilizers for this staple crop.

II.—STRAWBERRIES.

During the year, Bulletin No. 9, was issued, regarding this fruit, giving a comparison of varieties in the test plots and some notes on the special features of a number of selected varieties. During the Autumn, notes have been taken on the "Leaf Blight" or "Rust" of the strawberry (*Sphaerella Fragarie*.) which may be of interest.

This disease affects only the leaf, so far as can be seen, but it often so largely destroys the structure of the leaf, that its function is impaired and the plant is weakened and rendered unfruitful. This

TABLE No. III.—*Comparison of Leaf Growth and Leaf Blight, in varieties of Strawberries.*

VARIETIES.	PERCENTAGE OF		VARIETIES.	PERCENTAGE OF	
	Leaf Growth.	Blight.		Leaf Growth.	Blight.
Anna Forest.....	75	2	Lacon.....	80	20
Arlington.....	65	7	Lady Rusk.....	30	5
Belmont.....	60	60	Lenig's White.....	30	45
Bessie.....	85	6	Lida.....	60	15
Bidwell.....	95	1	Logan.....	40	20
Bubach No. 5.....	95	5	Lovetts Early.....	45	15
Bubach No. 132.....	100	10	Mammoth.....	70	70
Burt.....	70	35	Manchester.....	30	50
Captain Jack.....	50	40	May King.....	65	20
Carmichael.....	30	30	Miner's Prolific.....	70	10
Charles Downing.....	60	50	Monmouth.....	65	25
Cling-To.....	70	15	Mrs. Cleveland.....	90	30
Cloud.....	80	30	Mrs. Garfield.....	70	8
Cornelia.....	70	6	Mt. Vernon.....	75	20
Covell.....	75	50	Ohio.....	70	60
Covill's Early.....	50	20	Ontario.....	40	5
Crescent.....	75	35	Parry.....	30	25
Crystal City.....	85	10	Pine Apple.....	80	15
Cumberland.....	75	15	Piper.....	85	15
Daisy.....	60	40	Ruby.....	90	5
Dutter.....	75	12	Sharpless.....	75	30
Eureka.....	70	8	Stayman No. 1.....	90	30
Felton.....	65	35	Stayman No. 2.....	85	45
Gandy.....	80	10	Sucker State.....	60	8
Garretson.....	25	30	Summit.....	30	40
Gipsy.....	30	15	Surprise.....	70	40
Glendale.....	65	40	Thompson's No. 7.....	75	20
Gold.....	25	5	Thompson's No. 8.....	40	50
Great American.....	30	50	Thompson's No. 9.....	70	15
Haverland.....	80	3	Thompson's No. 25.....	40	80
Hoffman.....	70	3	Thompson's No. 26.....	70	90
Ironclad.....	80	20	Triumph de Gand.....	35	35
Itaska.....	50	25	Truitt Surprise.....	55	80
James Vick.....	65	10	Van Deman.....	85	2
Jersey Queen.....	25	10	Wilson.....	60	25
Jessie.....	85	10	White Novelty.....	45	15
Jewell.....	30	10	Woodruff.....	50	20
Kentucky.....	70	75			

blight forms dark red spots over the surface of the leaf, which become white and dead in the centre, as they mature, and frequently merge into one another, till they make large dead blotches, which often kill the entire leaf. The notes taken show the percentage of the leaves affected as compared with the percentage of leaves produced, in the several varieties. The Bubach, No. 132, produced the largest mass of leaves of any variety at this Station, and it was therefore taken as the standard for measurement of leaf growth and called 100 per cent. Only ten per cent. of its whole number of leaves or leaf surface, was affected by the rust. As an example, taken from the notes: the Parry made only 30 per cent. as much leaf-growth as the Bubach, No. 132; of this thirty per cent. of leaf-growth, one-fourth, or 25 per cent. of the leaves, were destroyed by the rust, or "leaf-blight." These notes have been put in the form of Table No. III., on the preceding page.

It will be seen by this table, that those varieties which had a thrifty growth, of sixty per cent. and upwards, and not over ten per cent. of the same blighted, were the following:

Bidwell.....1.	Ruby.....5.	Bubach, No. 132..10.
Van Deman...2.	Bubach, No. 5...5.	Gandy.....10.
Anna Forest...2.	Bessie.....6.	Crystal City.....10.
Haverland....3.	Cornelia.....6.	James Vick.....10.
Hoffman.....3.	Arlington.....7.	Miner's Prolific...10.
Daisy.....4.	Eureka.....8.	Jessie.....10.
	Mrs. Garfield...8.	

It will also be noticed that many of the prominent varieties are among those which are the most diseased. All things else considered—thrift, prolificness, shipping qualities—those varieties should be chosen which are least subject to leaf blight.

It has been noted while on the peninsula, that in the vicinity of Salisbury, Md. the Hoffman and Crystal City blight very little—no more than here at the Station.

Tests will have to be made, or observations taken, in different parts of the State, before such a report as this can be made reliable for the State as a whole, as soil, elevation and meteorological conditions, affect the severity of the attacks of fungus diseases. This subject will receive further attention the coming season.

Remedies. In the Fall, scatter a light coat of straw over the bed, and in the Spring, before growth begins, run over the bed with a

harrow to loosen up the straw. When dry, set fire to the straw. This will destroy nearly all the spores. Prof. Scribner recommends a solution of Potassium Sulphide, in the proportion of one ounce to eight gallons of water. Apply this by spraying once a week from the beginning of the growing season till the berries begin to ripen. He also suggests the use of a solution made of three ounces of carbonate of copper, dissolved in one quart of water, and this poured into twenty gallons of water, before using. Professor Dndley* suggests that it would be wise to apply such solutions after the crop is gathered, at intervals of two weeks, until September. Col. A. N. Pearson† when through picking, (June 27) sprayed some rows of strawberry plants with a solution of Sulphuric acid, one pint to six gallons of water. This killed all the leaves as if burned with fire. Soon a new growth started from the crowns, and by October 26, the contrast in the apparent health of the rows was quite perceptible. The sprayed rows were nearly healthy; those not sprayed were much diseased. He says the fungus disease must be prevented by beginning to spray early in the season.

Professor H. Garman, entomologist and botanist of the Kentucky Experiment Station, reports in Bulletin 31 of that Station a series of experiments in the application of Bordeaux mixture to strawberry plants for the prevention of leaf-bright, from which he draws the following conclusions:

1. Injury from strawberry leaf-bright can be largely prevented by the use of Bordeaux mixture and can celeste, and to some extent by potassium sulphide and London purple.

2. Bordeaux mixture is much superior to the other preparations used.

3. Applications of Bordeaux mixture should be made as often as once in two weeks. From the complete exposure of the leaves to rain, the mixture is removed from strawberry leaves much sooner than from grape leaves or those of trees.

4. Prepared according to the formula of bluestone, six and one-half pounds, lime, three and one-half pounds; water, twenty-two gallons; it may be sprayed without the slightest injury to leaves.

5. Twenty-two gallons of the mixture is sufficient for spraying during one summer 337½ feet of strawberry plants, as commonly

* Bull. xiv., Cornell Univ., page 181.

† Bull. No. 11, Sec. Veg. Pathology, page 49.

planted in rows; and will cost, considering the bluestone worth eight cents per pound, and lime worth one cent per pound, fifty-six cents. By buying material in quantity, this cost can be reduced.

6. A removal of the blighted leaves in summer, without the subsequent spraying, will increase instead of diminish injury from blight.

III.—POTATOES.

The work of further verifying, previously reported results of experiments with different sized potatoes used for planting, including whole and cut tubers, was continued the past year, being in all respects similar to the tests recorded in the Second Annual Report, page 51, excepting some change in the varieties used. Referring to that report for detailed explanations, the record for 1890 may be considerably condensed.

For the early crop, seed of the Early Rose was obtained from Maine, and this was supplemented by the New Queen, grown here last season. For late crop, the Early Maine, supplemented by Queen of the Valley, both from Aroostook county, Maine. One acre was prepared for early planting, being plowed March 22d. and one acre for late planting, plowed in April and May, and finally prepared on June 22d. Fertilizers applied were as follows, the land being already in fair condition for early crop: 250lbs muriate of potash, broadcast, and 200 lbs muriate of potash and 550 lbs ground dried fish, mixed, applied in drills: for late crop, 400 lbs muriate of potash, broadcast and a mixture in drills containing 150lbs nitrate of soda, 100lbs dried blood, 100lbs dried fish, 300lbs dissolved bone black and 100lbs of other phosphates. The arrangement of rows and distance of planting, same as in 1889, —rows $2\frac{1}{2}$ feet apart and hills 2 feet apart in the row. Early potatoes were planted March 26th, and late potatoes June 24th; in both cases, the seed was carefully dropped in the furrow, by hand, covered with a light plow, and then smoothly harrowed. On the early acre there were 48 rows, each 363 feet long, and on the late acre, 60 rows, each 200 feet long. As heretofore, the rows were planted in sets of fours, alternating across the field the four forms of seed compared, viz:

- A. A whole potato about ten ounces in weight.
 - B. A whole potato about the size of a hen's egg.
 - C. The usual cutting; piece of medium tuber, with 2 to 4 eyes.
 - D. A piece cut from medium tuber, and having one eye on it.
- One whole tuber or one piece, as described, in each hill.

As shown by the meteorological record appended, the season was decidedly unfavorable for the early crop, but a fair one for the late crop. Blight, which was not checked by treatment, was sufficient to lessen both crops. The New Queen proved an entire failure, and is omitted from the published records. The early potatoes were dug in September and the others late in October, and exact records made, as usual, of the product of every row, in pounds and ounces, and classified as merchantable and unmerchantable potatoes, according to the best judgment of the person in charge. From these records, the product per acre has been computed, from the four different forms of seed planted, and these three varieties, and the results follow.

TABLE No. IV.

Comparative Product of Potatoes, per Acre, in Bushels, from the four different forms of seed planted.

VARIETIES, ETC.	FORM A.	FORM B.	FORM C.	FORM D.
	Large Whole Potato.	Small Whole Potato.	Piece, as usually cut.	Piece cut to single eye.
<i>Early Rose.</i>	Bushels.	Bushels.	Bushels.	Bushels.
Total product, per Acre....	169½	111½	62	41
Merchantable potatoes.....	66	56½	31½	21½
Seed planted.....	76	24½	11	4
Product, good, over seed ..	10*	32	20½	17½
<i>Early Maine.</i>				
Total product, per Acre ...	282½	221½	125	77½
Merchantable potatoes.....	175½	152	94½	60½
Seed planted.....	65½	24¾	9½	4
Product, good, over seed...	110	127¼	85	56½
<i>Queen of the Valley.</i>				
Total product, per Acre....	283	212½	110¾	92
Merchantable potatoes.....	197¼	133½	88	74½
Seed planted.....	76¼	26	12	5½
Product, good, over seed...	121	107½	76	69

*Merchantable potatoes produced, less than seed planted. 10 bushels.

One of the most marked results in the record, is the effect of the form of seed upon the missing hills in a crop. In a season which is very favorable for the crop, throughout, this difference is less marked, but in an uncommonly dry season, or an uncommonly wet one, the whole tubers planted are very much surer to grow and give "a good stand," than any of the forms of cut potatoes. The facts in this respect, the present year, have been as follows:— total missing hills by actual count, on the two acres, by half acres, according to seed planted. A., 61; B., 155; C., 391; D., 574. Estimating the whole number of hills per acre (roughly) at 9,000, the loss of 500 of these as the result of cutting to a single eye, is more than the extra cost of seed in planting whole potatoes.

Often-times this matter of missing hills becomes a serious one; if a considerable percentage of the hills planted upon an acre fail to grow, the loss in the product of the acre is large, although the latter may not bear an exact ratio to the former. The records of this Station show, that in all seasons, the larger the (whole) potatoes planted, the fewer are the missing hills.

Otherwise, the record for this year is much the same as for previous years, and sustains, as a whole, the conclusions stated in former reports. In every case, the product is in the order of the lettering, A., B., C., D., the total bushels per acre and the bushels of merchantable potatoes, being greater, the greater the quantity of seed planted. The experience of the year favors on the score of economy, the practice of Section B., or the use of whole potatoes the size of an egg, requiring from 25 to 30 bushels of seed potatoes per acre. It will be seen by Table IV that in the Early Rose trial (a poor crop, however) the merchantable potatoes produced from the largest seed (Section A.) did not equal in quantity the seed used. And the Queen of the Valley was the only case, where the record shows there was an actual profit in planting seventy-six bushels of large potatoes to the acre.

The conclusions, from the year's work on potatoes may be re-stated, as follows:

1. The greater the quantity of seed planted, the greater the crop, in total product.
2. Generally, the more seed the more good potatoes of merchantable size.
3. The most profitable seed potatoes, on the average, are those of egg size, one whole tuber being planted in every hill.

4. The less the quantity of seed used, and the more it is cut, the less the probability of getting a full stand.

5. Cutting seed potatoes to a single eye, increases the missing hills so much, in an average season, as to materially reduce the crop.

IV.—COMPARISON OF SEED POTATOES FROM VERMONT AND MARYLAND.

Duplicate plantings of both Northern and Southern grown seed potatoes, were made this year at this Station and also at the Vermont Station, to verify the results of last year. Several varieties grown in Vermont were received and planted in rows alternating with tubers of the same varieties, grown at the Maryland Station in 1889. As stated in the last annual report, the conditions were made as nearly alike as possible at the two Stations, and the land was similar in character. It was impossible to get enough whole potatoes of uniform size from the two Stations, and therefore the seed tubers were cut, at both places, into pieces having two eyes each, and the gross weight of the two lots of seed, were made the same. Dates and details seem unnecessary. The results are given in Table No. V., on next page.

Similar trials have been made at other places with a view to determining the comparative merits of seed potatoes grown in widely separated localities, but the records generally show that the seed for such trials has been procured from different parts of the country, and grown under different conditions. Stock from different growers, however careful, is not uniform enough for a comparative test. In this case, both Stations started with the same seed, procured at the same place and divided. The annual generations resulting, have been used for the comparative seed. Table No. V. shows that this year, as before, the results are decidedly in favor of the Vermont-grown seed.

In every case, with the fourteen (14) varieties tried, the Vermont seed gave more merchantable potatoes than the Maryland seed, and the total product was greater from the Vermont seed, in twelve cases out of fourteen. The gross product from Vermont seed was almost double that from the Maryland seed, and the merchantable potatoes were three times as many.

V.—TEST ORCHARDS.

The test orchards were all plowed and thoroughly harrowed this Fall, to kill weeds and to prepare the ground for replanting in vacan-

TABLE No. V.

Comparison of Potatoes from Northern and Southern Seed—1890.

Field No.	VARIETIES, 25 HILLS EACH, CONTAINING ONE PIECE OF 2 EYES.	YIELD FROM MARYLAND GROWN SEED AT Md. EX. STATION.				YIELD FROM VT. GROWN SEED AT MARYLAND EX. STATION.				Weight of seed in ounces.	Missing hills Md. Seed.	Missing hills Vt. Seed.
		MERCH.		TOTAL.		MERCH.		TOTAL.				
		lbs—oz.	lbs—oz.	lbs—oz.	lbs—oz.	lbs—oz.	lbs—oz.	lbs—oz.	lbs—oz.			
4	Chas. Downing.....	1.05	3.13	5.02	5.15	4.11	10.10	14	5	1		
28	Stray Beauty.....	1.12	5.00	6.12	7.00	5.15	12.15	14½	0	2		
31	Thornburn.....	1.13	6.05	8.02	17.02	9.10	26.12	15½	2	0		
38	Dakota Red.....	4.14	3.13	8.11	16.12	2.05	19.01	14	5	0		
45	Monroe Co. Prize.....	4.05	5.12	10.01	5.06	3.13	9.03	13	3	5		
46	Morning Star.....	0.04	2.13	3.01	8.10	3.11	12.03	16	9	2		
55	Rural Blush....	3.05	2.03	5.08	11.00	5.13	16.13	12	15	3		
71	Delaware.....	3.10	5.01	8.11	4.10	5.01	9.11	14½	0	4		
70	Charter Oak.....	3.14	11.04	15.02	3.14	6.03	10.01	12½	0	4		
75	Farina.....	1.00	2.10	3.10	2.10	2.10	5.04	10½	7	3		
82	Home Comfort.....	1.05	1.12	3.01	4.04	2.03	6.07	10	9	7		
102	White Beauty of Hebron.....	5.06	4.11	10.01	13.02	7.05	20.07	14½	14	0		
107	Gregory's No. 1.....	1.11	4.14	6.09	5.07	4.13	10.04	11½	8	1		
108	Notts No. 8 or Mrs. Cleveland.....	0.12	2.12	3.08	3.03	6.02	9.05	14	15	3		
	Total lbs and oz.	35.04	62.11	97.15	108.15	70.03	179.00					
	Average 14 varieties.....	2.08	4.08	7.00	7.14	5.00	12.13					

cies. The trees of these orchards, while not in the best condition, will in most cases of the Peach, Plum and Cherry and some few Pears and Apples, bear a few specimens of fruit the coming season. As the trees were pruned rather high when set out, they will have to be "headed back" this Winter. The number of varieties will be increased as opportunity occurs.

VI.—NURSERY.

To facilitate the increase of our test stock, make some important tests in the propagation of nursery stock and produce stock for trial tests in different parts of the State having soils and altitudes unlike those of this Station, we will start a small nursery the coming Spring. We urge all those having any valuable variety that has never been distributed beyond the locality of its origin, to send us scions six inches in length, of the past season's growth, and vigorous, that we may test them and disseminate whatever merits we may observe. In sending scions, wrap them tight in damp sawdust, moss, or a little rotted hay; cover first with a damp cloth and then wrap tightly with several thicknesses of dry paper. Be sure that the butt ends of the cuttings are securely covered by the damp material.

VII.—VINEYARD AND GRAPE CULTURE.

As a large portion of this State is well suited to the successful growth of the grape, a large test vineyard will be started next Spring, and some experiments on the cultivation of the vine. A full set of native species, twenty-two in all, have been secured from Prof. T. V. Munson, of Denison, Texas, and forty-one varieties have been received from the Texas Agricultural Experiment Station.

Maryland is the home of some very prominent species of grapes, notably *Vitis Labrusca*, the parent of the Concord, Catawba and a long list of other varieties. Also *Vitis Estivalis*, parent of Norton's Virginia, Cynthiana, Hermann and others; *Vitis Riparia*, parent of Bacchus, Elvira, Clinton and many others, and *Vitis bicolor*, our Winter grape. These wild forms grow here with great vigor and indicate that the vineyard interests of the State should be far greater than they now are. Moreover, since it has become a matter of very small outlay to cope with the fungus diseases and insects that infest the vine, success in grape culture can be practically guaranteed.

to all who will pursue the improved methods. There is no reason why grape culture should not become equal to the peach and strawberry interests in this State.

VIII—LABORATORY.

This department now has a fairly complete laboratory, fitted up for the study of plant diseases and histological subjects. It has a fine Zeiss microscope with attachments, chemicals, coloring fluids and other apparatus needed in this important work.

IX.—ORCHARD FERTILIZER TEST.

In order to ascertain the effect of various fertilizers on both tree and fruit of orchards, five rows of trees, each consisting of twelve apple trees and twelve peach trees, were planted in December, 1888, for this purpose. Each row had two trees of each of the following list of apples and one each of the following list of peaches:

Apples.

Carolina Red June.
Early Harvest.
Red Astrachan.
Sweet Bough.
Maiden's Blush.
Fall Pippin.

Peaches.

Amsden.	Crawford Ea.
Waterloo.	Chinese Cl.
Beatrice.	Alberta.
Hale's Early.	George 4th.
Yellow St. John.	Old Mixon Free.
Mt. Rose.	Stump.

On May 16, 1890, the first application of fertilizers was made on a strip of land six feet wide—three feet on each side of the row.

Each row was treated as follows:

First Row. Received nothing.

Second Row. A "complete fertilizer" compound, viz:

Dried Blood, 14 lbs, 6 oz.—240 lbs per acre.

Muriate Potash, 9 lbs, 9 oz.—160 lbs per acre.

Dissolved Bone Black, 19 lbs, 3 oz.—320 lbs per acre.

Third Row. Nitrogen only, in the form of Dried Blood, 14 lbs, 6 oz.—240 lbs per acre.

Fourth Row. Phosphoric acid only, in Dissolved Bone Black, 19 lbs, 3 oz.—320 lbs per acre.

Fifth Row. Potash only, in Muriate of Potash, 9 lbs, 9 oz.—160 lbs per acre.

X.—BLACKBERRY RUST.

Knowing that it is very important in making the choice of varieties, to know their susceptibility to fungus diseases, the following notes were taken October 15th, on the orange rust (*Caomanitens*, Schw.) that has caused such ruinous results in many parts of the country, in the culture of the Blackberry.

VARIETIES.	Percentage of Rust.	REMARKS.
Agawan	60	Badly affected.
Ancient Briton	60	" "
Thompson's Ea. Mammoth...	5	Very little rust, but affected badly with a spot disease, (<i>Septoria rubi</i> .) Not as bad a disease as the rust.
Minnewaski	65	Severely rusted.
Early Harvest	10	Only slightly affected; heavy leaf growth.
Early Cluster	40	Not reliable.
Kittatinny	80	Very heavily affected, but made a good growth of wood.
Crystal White	10	Good growth of wood and but slightly affected.
Erie	100	Leaves all badly affected, but had made a fair growth of wood.
Wilson's Early	20	Strong growth and but little rust.
Lawton	65	Good growth but leaves badly affected.
Wilson's Junior	20	But little rust; strong growth; some spot disease.
Snyder	70	Badly affected; fair growth.
Early King	100	Leaves all destroyed by rust. Bore heavily the past season; light growth.
Taylor's Prolific	90	Slim growths; leaves nearly all gone by rust.
Wachusett	30	Not very badly rusted; most leaves yet remain; vigorous growth.
Tyler	90	Light colored cane; fairly vigorous growths but severely affected by rust.
Child's Everbearing	10	Light growth; but little rust.
Jewett	5	Very slightly affected; leaves yet remain on vines; light growth.
Lincoln	80	Heavily rusted; medium growth.

By reference to the season's field notes, it is observed that those varieties which bore the heaviest crops during the season, were most severely affected. This follows a well known law, that heavy bearing weakens the constitutional vigor of plants and increases their susceptibility to disease. It is shown by the list above, that those which gave a strong growth of wood and were least affected by the rust, are Wilson's Early, Wilson's Junior, Wachusett, Early Harvest, Crystal White and Thompson's Early Mammoth.

Insusceptibility to this rust is a very important factor for future success. The Kittatinny is one of the best berries, but rusts too severely in many parts of the State, to advise its planting on an extensive scale.

XI.—NOTES ON VEGETABLE TESTS.

There were a large number of varieties of vegetables grown on the test grounds the past season, but owing to a change of the head of this department, the notes are not complete enough to be of much value to the public. Past records which may be of some interest, are as follows:

BEANS. Of the Bush beans tested, Blue-podded (Burpee), Boston Small Pea (Gregory), First in Market (Landredth), were of no value here. Early six Weeks (Thorburn), Snowflake, (Gregory). Nonpariel (Maule) were fairly productive.

Of the wax varieties, the Golden Queen (Dreer) is the best, followed by Rust Proof (Cowan). Others that are very good are Perfection (Burpee), Refugee Wax (Thorburn) and Saddle back (Burpee).

CABBAGE. The Cabbages giving the best results, were the various strains of Early Jersey Wakefield.

Plants transplanted twice were inferior to those grown in the boxes without transplanting.

CUCUMBERS. Among the varieties grown, the Improved White Spine (Thorburn) was the best and most prolific, Bennett's White Spine (Cowan), Early White Spine (Plant Seed Co.), White Spine Extra Early (Livingston) were all good bearers of even fruit.

XII.—ACKNOWLEDGMENTS.

The Horticultural Department of this Station is under obligations for the following liberal donations:

J. C. Bauer, Judsonia, Ark. Originator. One dozen Van Deman strawberry plants.

Benjamin Buckman, Fanningdale, Ill. Seions of the following varieties of apples: May of Myers, Minkler, Rock Pippin, Salome, Shannon, Vaughn's Winter, Withe, Neil's Keeper.

Division of Forestry, U. S. Department of Agriculture. Set of Austrian Osier Willows.

Division of Pomology, U. S. Department of Agriculture. Three Seedling Gooseberry plants that originated at Naperville, Ill., by Phil. Strubler. Three native plums of California.

J. Lovett & Co., Little Silver, N. J. Raspberry and Gooseberry plants to fill in vacant spaces in former purchases.

Texas Experiment Station, College Station, Tex. Forty-one varieties of rooted grape vines and thirty-three varieties of grape cuttings.

Franklin Davis & Co., Baltimore, Md. Seven new varieties of pears. Big Bartlett, Blight Proof, Big Seckel, Large Late, Russett, Quince pear, Blight Proof Red.

Brighton Grange, Brighton, Md. Number of new strains of garden seeds.

T. L. B.

REPORT OF THE CHEMIST.

By HARRY J. PATTERSON, B. S.

The work of the chemical department during the past year has dealt with quite a variety of subjects; more time has been given purely to investigation during this than the previous year. It is hoped that as the work of the Station is becoming better defined, more and more time can be given to investigations of a lasting character and that this department will make itself increasingly useful to the other departments of the Station in aiding their researches.

Much of the summer and fall months were occupied with tomatoes, in duplicating the work of 1889 and going into the composition of the fertilizing constituents of the ash of the fruit, vine and root. This work has been reported and can be found in the Bulletin No. 11, for December, 1890.

Considerable time has been given to the study and investigation of methods of analysis, both individually and in co-operation with the Association of Official Agricultural Chemists. Many may object and criticize our spending time for this line of work and say that it is of no benefit to those for whom we are working; but on a moment's reflection all must admit that the value of our work depends to a great extent upon the methods pursued in our researches. On this ground we feel justified in spending much time on what may be considered as matters of interest only to chemists. It is true that by this course we may be able for the time being, to give less matter, seemingly, of practical value to farmers; yet we will feel surer of the correctness of the fundamental principles used in obtaining that which we do give.

A number of investigations are in progress at the present time, but not enough work has been done on them as yet to warrant more than brief mention here. They are as follows:—1. Methods for the determination of hygroscopic moisture in feeding stuffs; 2. Effect of food on the digestibility of milk; 3. Heat-producing power of various fats, oils, waxes and resins; 4. Effect of acids and alkalis on germinating seeds; 5. Methods of composting marls in order to change the plant food to an available form; 6. Sources of phosphates in fertilizers.

During the year 280 samples have been received in the laboratory, classified as follows:—

110 samples of tomatoes, 90 fodders, 30 milks, 24 marls, 24 fertilizers, and 2 miscellaneous. These, with the investigations in progress involved about two thousand determinations, together with the keeping of the records and the results in proper shape for publication and preservation. The results as far as ready for publication, will follow this and also the meteorological records as far as kept at this Station: the latter have been in the care of this department.

I.—MARLS.

Marls are found in large quantities in many parts of Maryland, and have been used more or less for agricultural purposes for many years. From the small quantity of plant food which marls furnish and the difficulty and expense of handling and transportation, their use is generally confined to places very near the deposits.

Marls are divided into three classes, according to their general character and the geological formation to which they belong. As a rule they occur in formations one above the other, but it is rare that more than one appears in a single exposure. The upper layer is known as shell marl, or blue marl, and is generally found at or very near the surface. It consists chiefly of sea mud, with sand and clay and partially decayed shells and bones. Its value depends mainly on lime, which it contains in the form of the carbonate. This class of marl usually has a small per cent. of phosphoric acid and potash. The physical character of calcareous marls varies with the class of animal remains from which they are derived and the state of preservation of the same. To this class belong most of the marls that have been examined at this Station.

The second class of marl is known as eocene marl and is friable and somewhat chalky, consisting of comminuted shells and corals, and is of a light color. Deposits of glauconite or green sand are found in this formation. The main agricultural value of this variety is in the carbonate of lime which it furnishes, but it also has a small per cent. of phosphoric acid and potash.

The third class, or that which has the lowest position is the cretaceous marl. This also contains glauconite and is commonly known as "green sand" in New Jersey. There are very few exposures of this formation in Maryland and it is difficult to distinguish it from the eocene. Marls of this class vary considerably in their chemical

composition and agricultural value. They owe their fertilizing quality to the presence of phosphoric acid and potash, and sometimes contain a goodly admixture of calcareous matter. The best New Jersey marls and those that have been used with the most success, have contained from two to three per cent. of phosphoric acid and from five to seven per cent. of potash. The few Maryland marls of this class that have been examined here, thus far, have not given nearly as high a per cent. of these ingredients.

The potash of marls being in an insoluble form must necessarily act very slowly in the soil. With the object of getting some cheap method of converting the potash to a form more available to plants, this Station has now in progress a series of experiments in the composting of marls.

Expecting in the future to give a more extended and detailed discussion of marls, their composition and the extent of the deposits, we will now simply give a brief description of the samples already examined and the plant food they have been found to contain. These are in addition to those recorded in our last Annual Report, at page 83.

INDEX No. 536.

Sent in by Thos. F. Lansdale, Esq., Tridelphia, Md.

Sample taken from bottom of gully on a farm in Anne Arundel County. Light gray in color and partially decomposed.

Potash.....	0.25 per cent.
Phosphoric acid.....	trace.
Lime.....	"
Carbonic acid.....	"

INDEX No. 537.

Sent in by Thos. F. Lansdale, Esq., Tridelphia, Md.

Sample taken from same farm as No. 536, though from different place. Vein larger and nearer the surface. Light gray, sandy appearance.

Potash.....	0.26 per cent.
Phosphoric acid.....	trace.
Lime.....	"
Carbonic acid.....	"

INDEX No. 585.—*Shell Marl.*

Sent in by Thos. R. Brooks, Esq., Seat Pleasant, Md.

Sample taken in ravine along small stream at the most southern part of farm. Mixture of sand with clam and spiral shells.

Composition of Air-Dry Sample.

Water	1.55 per cent.
Insoluble Matter	65.48 "
Lime [CaO]	12.37 "
Potash	1.41 "
Phosphoric acid	0.24 "

INDEX No. 586.—*Blue or Green Sand.*

Sent in by Thos. R. Brooks, Esq., Seat Pleasant, Md

Sample taken in ravine at forks of two streams about twenty yards from No. 585, and an underlying stratum. Bank of ravine about eight feet high.

Composition of Air-Dry Sample.

Water	1.00 per cent.
Insoluble Matter	76.11 "
Lime [CaO]	4.38 "
Potash	1.84 "
Phosphoric acid	0.30 "

INDEX No. 587.—*Shell Marl.*

Sent in by Thos. R. Brooks, Esq., Seat Pleasant, Md.

Sample taken from pile that had been exposed about fourteen months. Mixture of chocolate colored sand with clam shells and some spiral shells and sharks' teeth. This represents the material that had been used on the farm with good results.

Composition of Air-Dry Sample.

Water	1.53 per cent.
Insoluble Matter	69.37 "
Lime [CaO]	9.88 "
Potash	1.62 "
Phosphoric acid	0.16 "

INDEX No. 588.—*Shell Marl*

Sent in by Thos. R. Brooks, Esq., Seat Pleasant, Md.

Sample represents upper layer of Shell Marl. Layer about one foot thick and three feet below surface soil. Shells mostly clam, of good size, and well preserved. Layer darker in color than layer below.

Composition of Air-Dry Sample.

Water	1.30 per cent.
Insoluble Matter	51.42 "
Lime [CaO]	22.20 "
Potash	2.85 "
Phosphoric acid	0.16 "

INDEX No. 589.—*Shell Marl.*

Sent in by Thos. R. Brooks, Esq., Seat Pleasant, Md.

Sample taken from layer immediately under No. 588. Layer about four feet thick. Shells small in size and soft—partially decomposed. This is the same layer as Sample No. 587 was taken from.

Composition of Air-Dry Sample.

Water	1.50 per cent.
Insoluble Matter	64.54 "
Lime [CaO]	12.37 "
Potash	1.39 "
Phosphoric acid	0.12 "

INDEX No. 590.

Sent in by Thos. R. Brooks, Esq., Seat Pleasant, Md.

Taken from layer immediately under Sample No. 589. Layer about two and one-half feet thick. Chocolate brown sand in appearance.

Composition of Air-Dry Sample.

Water	1.50 per cent.
Insoluble Matter	81.22 "
Lime [CaO]	1.50 "
Potash	2.08 "
Phosphoric acid	0.20 "

INDEX No. 591.—*Blue or Green Sand.*

Sent in by Thos. R. Brooks, Esq., Seat Pleasant, Md.

Taken from layer below No. 590. Layer of unknown thickness. Some shells embedded in this layer.

Composition of Air-Dry Sample.

Water	0.98 per cent.
Insoluble Matter	81.84 "
Lime [CaO]	1.00 "
Potash	1.71 "
Phosphoric acid	0.20 "

INDEX No. 592.—*Shell Marl.*

Sent in by Thos. R. Brooks Esq., Seat Pleasant, Md.

Taken from bed of stream near barn. Bluish gray appearance. Comes out in quite hard lumps.

Composition of Air-Dry Samples.

Water	0.68 per cent.
Insoluble Matter	53.34 "
Lime [CaO]	16.87 "
Potash	2.29 "
Phosphoric acid	0.16 "

INDEX No. 593.

Sent in by R. S. Mitchell, Esq., Glymont, Md.

Sample hard rock formation. Marked "Phosphatic rock."

Water.....	0.68 per cent.
Insoluble Matter.....	36.09 "
Lime [CaO].....	29.00 "
Potash.....	0.15 "
Phosphoric acid.....	0.12 "

INDEX No. 594.

Sent in by Dr. Chas. Lowndes, Easton, Md.

Taken from deposit on "Dundee Farm." White, chalky appearance.

Water.....	0.35 per cent.
Insoluble Matter.....	13.21 "
Lime [CaO].....	45.88 "
Potash.....	0.24 "
Phosphoric acid.....	0.16 "

INDEX No. 610.

Sent in by Dr. Chas. H. Tilghman, Tunis Mills, Md.

Deposit is on a river on western side of Chesapeake Bay. Used by a fertilizer manufacturer. Claimed to contain 0.48 per cent. of Phosphoric acid. Is of a light gray color.

Composition of Air-Dry Sample.

Water.....	0.90 per cent.
Insoluble Matter.....	57.58 "
Lime [CaO].....	20.90 "
Potash.....	0.29 "
Phosphoric acid.....	0.40 "

INDEX No. 611.

Sent in by Dr. Chas. H. Tilghman, Tunis Mills, Md.

Sample of a dark gray color. Taken from same deposit and used by same fertilizer manufacturer as sample 610. Claimed to contain 0.55 per cent. of Phosphoric acid.

Water.....	0.98 per cent.
Insoluble Matter.....	74.00 "
Lime [CaO].....	13.12 "
Potash.....	0.38 "
Phosphoric acid.....	0.28 "

INDEX No. 612.—*Muck.*

Sent by Dr. Chas. H. Tilghman, Tunis Mills, Md.

Muck taken from same deposit and used by same fertilizer company as Nos. 610 and 611. Claimed to contain 0.73 per cent. Nitrogen and 0.31 per cent. Phosphoric acid.

Composition of Air-Dry Sample.

Water.....	5.80 per cent.
Insoluble Matter.....	71.54 “
Organic Matter.....	20.88 “
Lime [CaO].....	trace
Potash.....	0.69 “
Phosphoric acid.....	0.28 “
Nitrogen.....	0.81 “

INDEX No. 605.—*Marsh Mud.*

Sent in by Thos. Hill, Esq., Baltimore Md.

Marsh mud taken from farm about one mile south of Tolchester beach on the Chesapeake Bay. Represents surface layer about ten inches thick.

Composition of Air-Dry Sample.

Water.....	3.15 per cent.
Insoluble matter.....	87.57 “
Organic matter.....	2.34 “
Lime [CaO].....	1.38 “
Potash.....	0.23 “
Phosphoric acid.....	0.12 “
Nitrogen.....	0.21 “

INDEX No. 606.—*Marsh Mud.*

Sent in by Thos. Hill, Esq., Baltimore, Md.

Taken from layer immediately under 605, and ten inches deep.

Composition of Air-Dry Sample.

Water.....	2.78 per cent.
Insoluble matter.....	87.34 “
Organic matter.....	2.34 “
Lime [CaO].....	1.25 “
Potash.....	0.22 “
Phosphoric acid.....	0.14 “
Nitrogen.....	0.24 “

In order to have these results in form for ready reference, they are summarized in the following tables:

TABLE No. VI.
Composition of Maryland Marls.

PER CENT. IN AIR-DRY SAMPLE.

Index No.	Water.	Insoluble Residue.	Lime.	Phosphoric Acid.	Potash.
536	.....	.....	trace.	trace.	0.25
537	.....	.....	"	"	0.26
585	1.55	65.48	12.37	0.24	1.41
586	1.00	76.11	4.38	0.30	1.84
587	1.53	69.37	9.88	0.16	1.62
588	1.30	51.42	22.20	0.16	2.85
589	1.50	64.54	12.37	0.12	1.39
590	1.50	81.22	1.50	0.20	2.08
591	0.98	81.84	1.00	0.20	1.71
592	0.68	53.34	16.87	0.16	2.29
593	0.68	36.09	29.00	0.12	0.15
594	0.35	13.21	45.88	0.16	0.24
610	0.90	57.58	20.90	0.40	0.29
611	0.98	74.00	13.12	0.28	0.38

TABLE No. VII.
Composition of Muck and Marsh Mud.

PER CENT. IN AIR-DRY SAMPLE.

Index No.	Water.	Insoluble Residue.	Lime.	Phosphoric Acid.	Potash.	Organic Matter.	Nitrogen.
605	3.15	87.57	1.38	0.12	0.23	2.34	0.21
606	2.78	87.34	1.25	0.14	0.22	2.34	0.24
612	5.80	71.54	trace.	0.28	0.69	20.88	0.81

II.—STUDY OF LABORATORY METHODS.

*The Use of Animal Charcoal in the Determination of Fat
(Ether Extract) in Feeding Stuff.**

The crudeness of the product which goes under the term "ether extract" in fodder analyses is a thing that has impressed itself upon all who have to any extent been engaged in the determination of the various constituents of farm products. How to get rid of a portion, if not all, of this extraneous matter, and have nothing but fat or very closely allied products, has been an interesting question, up to this time unsolved.

To obviate this difficulty I have successfully used animal charcoal, and have obtained a product which in many cases was nearly pure vegetable oil, and in no instance could much foreign matter be detected, getting in every case a product having the general appearance and characteristics of pure fats.

The preparation of the sample and manner of treating the extract has been precisely that adopted by the Association of Official Agricultural Chemists. In filling the percolator tube there was first placed in it the animal charcoal, on top of this a plug of cotton, then the substance to be extracted, and finally another plug of cotton. The cotton serves to make a more uniform stream of ether over the substance, and keeps the latter from crawling up the sides of the percolator.

The plug between the substance and the charcoal will prevent any of the fat coming in contact with the charcoal before it is thoroughly in solution. In a few instances, especially in the case of grains, it was found that the results were a little too low if the fat came in contact with the charcoal before it was thoroughly held in solution by the ether.

In all cases one gram of the substance was used. With grains and meals one gram of charcoal was used, and with hay, fodders, and the like, two grains. The amount of charcoal can be varied at the discretion of the analyst, but the above amounts were found satisfactory. The animal charcoal was a pure article, of medium fineness, thoroughly dried, extracted with ether, and again dried and preserved for use in a well-stoppered bottle. The cotton was of good quality and clean, and had been extracted with ether previous to use.

*Already published, by permission, in the American Chemical Journal, Vol. VII No. 4.

In the following discussion the method of the Association of Official Agricultural Chemists is designated as Method I, and where charcoal has been employed, as Method II.

To prove that there is no loss in passing of pure fat through charcoal, a number of fats were absorbed on cotton and extracted by each of the two methods. The results are given in the following table (A):

TABLE A.

Sample.	METHOD I.			METHOD II.		
	Fat Added. Gram.	Fat Recovered. Gram.	Loss or Gain. Gram.	Fat Added. Gram.	Fat Recovered. Gram.	Loss or Gain. Gram.
Cotton seed oil,	.2180	.2180	0000	.1770	.1760	—,0010
“ “	.2020	.2025	+ ,0005	.2015	.2010	—,0005
“ “	.2015	.2010	—,0005	.1815	.1810	—,0005
Average,	.2072	.2072	0000	.1867	.1860	—,0007
Butter,	.1775	.1770	—,0005	.1765	.1760	—,0005
“	.1520	.1510	—,0010	.1880	.1870	—,0010
“	.0910	.0910	0000	.1030	.1035	+ ,0005
Average,	.1402	.1397	—,0005	.1558	.1555	—,0003
Mutton tallow,	.1160	.1165	+ ,0005	.1470	.1480	+ ,0010
“ “	.0960	.0960	0000	.0925	.0930	+ ,0005
“ “	.0970	.0970	0000	.0810	.0815	+ ,0005
Average,	.1030	.1032	+ ,0002	.1068	.1075	+ ,0007
Lard,	.0675	.0670	—,0005	.1415	.1420	+ ,0005
“	.1345	.1340	—,0005	.0925	.0930	+ ,0005
“	.2330	.2325	—,0005	.0660	.0660	0000
Average,	.1450	.1445	—,0005	.1000	.1003	+ ,0003
Beef tallow,	.1100	.1100	0000	.1125	.1120	—,0005
“ “	.1515	.1520	+ ,0005	.1545	.1540	—,0005
“ “	.0965	.0965	0000	.1335	.1335	0000
Average,	.1193	.1195	+ ,0002	.1335	.1332	—,0003
Sum of averages,	.7147	.7141	—,0006	.6828	.6825	—,0003

From this table it will be seen that there is no appreciable loss, and that the two methods are about the same when pure fats are being extracted. The different fats employed give about as much range in composition and physical characters as would be expected in the various vegetable fats.

In Table B is given a comparison of the two methods on a variety of samples, which cover fairly well the different classes of substances

met with in agricultural analysis. A comparison of the results given in Table B shows that there is a difference in every case, Method I giving the higher result, and in some cases the difference is surprising. This shows that the amount of error which has been introduced into our valuations of feeding stuffs, calculation of digestibility and nutritive ratios is very much more exaggerated and misleading than has been supposed. The results in Table B are the average of triplicate determinations.

TABLE B.

DESCRIPTION OF SAMPLE	I.	II.	Difference Per Cent.
	Per Cent. Fat.	Per Cent. Fat.	
Clover hay.....	3.51	2.02	1.49
Corn fodder.....	6.17	2.69	3.48
Corn meal	4.63	4.53	0.10
Cotton seed meal.....	10.50	9.88	0.62
Dung from digestion experiment on cotton seed meal..	5.83	3.83	2.00
Oats hay.....	4.12	2.57	1.55
Soja bean silage.....	5.53	4.70	0.83
Sorghum fodder, "Early Orange".....	5.46	2.70	2.76
Sorghum silage, "Amber".....	6.15	3.68	2.47
Tomatoes (dried).....	10.07	6.48	3.59
Unknown pea.....	3.44	1.76	1.68
Wheat bran.....	3.80	3.33	0.47

Having noticed the acidity of the smell of the extract of some of the samples and of ether which was distilled from the extract of some plants, a few tests of the amount of acid in the extracts, soluble in cold water, were made by titrating it with decinormal sodium hydrate, phenolphthalein being used as an indicator. In nearly every case some acid was found in the extract of Method I, reaching over 1 cc. in some cases, there being scarcely a trace from the extract of Method II. The only case in which there was an appreciable amount of acid in the extract of Method II, was from the sorghum silage. This on further research was found to be due to the acetic acid which such samples contain. After the trial of a number of materials for removing this, it was found that by mixing copper dust or filings with the charcoal, that the acid could be reduced to an inappreciable amount.

From a study of these figures and a close examination of the products obtained by the two methods, it seems that the use of charcoal results in a closer approximation to the truth than any other method

in use, though absolute accuracy is not claimed. The following points may be rightly claimed in favor of the use of animal charcoal in the determination of fat (ether extract) in feeding stuffs.

- (1). That the product obtained is nearly pure fat or vegetable oil.
- (2). That the product obtained gives a more correct idea of the physical nature of the fats from various substances.
- (3). That slight quantities of water that may exist in the substance and pass out with the extract, will be removed by the charcoal.
- (4). That soluble acids of the plant, or acid which may be formed by the continuous distillation of ether, in connection with some constituents of plants, will be partially, if not wholly, removed by the animal charcoal.
- (5). That the animal charcoal will partially obviate, if not wholly remove, the difficulty of change in the amount of ether extract (which generally increases) with the aging of the sample.

H. J. P.

REPORT OF THE MECHANICAL DEPARTMENT.

BY E. H. BRINKLEY.

General Duties. The work of this department was sufficiently described in the last annual report and need not be repeated. The only changes that have occurred are incident to the general increase in work at the Station and also at the College, and in regard to special duties assigned to the machinist during the summer months. Instead of the sorghum grown here in 1889 for the U. S. Department of Agriculture, the latter engaged with this Station to grow two and one-half acres of Sugar Beets, during the season of 1890. The field work, sampling, etc., in this connection was under the supervision of the machinist.

Boiler and Coal. The demands for steam were greater than last year, for heating and laboratory work, for pumping and for threshing and like work. The boiler has done good service and has been easily managed. During the full calendar year of 1890, there have been consumed $47\frac{1}{2}$ tons of hard coal.

Pumping and Power. The pump has also continued to do good work, and with immaterial repairs has raised 768,000 gallons of water to our tanks, during the year, being operated more or less on 258 different days. It has also been used as an engine frequently, for operating the imported German mill, used in grinding samples for the chemist, and for the new cylinder and shaker, mentioned later as used for threshing.

New Farm Implements. The only implements purchased during the year, which have received the attention of this department, are a Thresher for experimental lots of grain, a Hay Rake and Tedder, combined, and an Insecticide Gun.

The Thresher was made by Minard Harder of the Empire Agricultural Works, Cobleskill, New York, and consists of a 32-inch open over-shot cylinder, with a plain wooden shaker attached. This simple form was selected because our threshing is in numerous small lots, ranging for two quarts to one hundred bushels of cleaned grain and as it is of importance to prevent a single kernel of one variety from getting mixed with any other, it becomes necessary to completely

empty and clean the thresher after every lot representing a distinct variety of grain, or the product of a particular plot or area. This cleaning can be quickly and thoroughly done with this simple machine, and in handling nearly two hundred different lots with it the past season, it has proved very satisfactory for this class of work. This thresher cost \$62.00, and was found to do good work with about two horse power in the form of steam; it appears therefore to be suited for practical farm work, on a small scale, as regards cost, power, efficiency and ease of management.

The Combined Horse Rake and Tedder was made by the Ohio Rake Company of Dayton, and is called by them the Haymaker and Grain Lifter. Like all combined implements, it is heavier in draft and more complicated in its parts than either implement by itself, in their usual forms. We have not had altogether satisfactory conditions as yet, for testing it as a tedder, or "grain-lifter," but as a rake, it has been found clumsy and inconvenient and cannot be recommended. The regular price is \$32.00.

The Insecticide Gun was made by Leggett Brothers, No. 301 Pearl St., New York City, and cost \$12.00. It is a very effective little implement in which a magazine, fan and barrel, or discharger, are combined for projecting Paris Green, Hellebore, or any insecticide or fungicide, in the form of dry, fine powder, upon plants, bushes or vines. It is light, well-made, easily operated, and very "handy."

Needs of this Department.—The present accommodations of this department are not suited to its work. The room for boiler and pump are all right, but another room is needed in which the necessary tools and other facilities can be placed for doing all sorts of repairing of farm implements and machinery and illustrating how this can be done in the best, the easiest and the cheapest manner. Of course, such provisions will be unnecessary at this Station, if a mechanical department is established and fully equipped at the College.

Recommendations.—This is believed to be the only Experiment Station which has a Mechanical Department, and it is respectfully suggested that in this case the work of the department may be extended so as to make the Station increasingly useful. It is recommended that arrangements be made for establishing, upon a somewhat extensive scale, a Station for continually exhibiting, comparing

and testing various farm implements and machinery. By providing for testing all of a kind under like conditions and in the presence of interested farmers, when desired, it is believed that the Station may perform valuable work in thus standing between the manufacturer and the farmer. A special building will be necessary, to be roomy and furnished with shafting, pulleys and power, but the structure may be shed-like and inexpensive. It may be expected that manufacturers will be glad to avail themselves of such an opportunity to exhibit to the practical farmers of this State, the most improved patterns of their implements and to have them thus impartially and thoroughly tested, in comparison with others of like character. This Station should provide the building, furnish the power, keep all implements and machinery in good order, ready for examination at any time, and conduct comparative trials at stated times. The tests should not only include the questions of draft and power, harmony of mechanism and efficiency in work, but also the character of material, durability or wearing qualities, the correctness of the mechanical principles as applied, and the determination of weak points or defective parts. The results of all tests and trials should be published in the bulletins or reports of the Station, for the benefit of all interested.

Sugar Beets.—The facts as to this work, in charge of the machinist, are published as a special report, see next page.

E. H. B.

SPECIAL REPORT ON SUGAR BEETS,

GROWN FOR THE U. S. DEPARTMENT OF AGRICULTURE.

Two and one-half acres of land were cultivated in Sugar Beets, during the season of 1890, for the Chemical Division of the U. S. Department of Agriculture. This was in connection with the general sugar investigation of the Department, and with special reference to the saccharine quality of the different varieties tried here, and the effect thereon of the various commercial manures applied.

The land used was a portion of the Sorghum Field cultivated for the Department in 1889, and described at pages 148-49, in the Second Annual Report of this Station. And it was the central portion of that field, which was selected for beets. The five varieties of beets were on long, narrow, half acre strips, running East and West, these were divided into twenty plots, running North and South, receiving as many different fertilizers or combinations of fertilizers. The latter were the same as applied to the same plots, for sorghum, the year before, it being hoped that the special effects would be thus intensified. The five (5) varieties of beets were as follows: No. 1., Dipp's Vilmorin; No. 2., Simon Le Grand's White Improved; No. 3., Bulteau Desprez' Richest; No. 4., Florimond's Desprez Richest; No. 5., Dipp's Klenswazeblen. These were sown in drills 700 feet long and 2 feet apart.

The soil was plowed and sub-soiled, being thus worked at least a foot in depth, and repeatedly harrowed and rolled, until an excellent seed-bed was prepared. Seed was sown June 7th, with a Planet Junior drill. A very heavy rain soon followed and packed the earth so hard as to greatly interfere with vegetation, resulting in a poor "stand." Cultivation was thorough, with double wheel or push hoes and common hand tools. An attempt was made to improve the stand and make it more even, by transplanting, but the July drouth destroyed the plants thus moved. The crop was light and the size of the roots averaged rather small.

All examination of the beets was made at the Chemical Division of the Department of Agriculture, to which, under instructions received, sample roots were sent, every other day, from October 24th to December 2d. Every shipment represented all five varieties, as grown upon one fertilizer plot. At each shipment twenty or thirty

average beets were pulled, and from these, two roots selected as fairly representing a variety; ten roots were thus sent each time and delivered at the department the day they were pulled.

The results of the analyses were reported from the Department as fast as made. These facts properly belong to the chemical portion of the report, but a summary is appended of the average results, and this shows the size and quality of the beets, of the different varieties.

TABLE VIII.—*Size and Quality of Sugar Beets.*

No.	VARIETY.	Weight of Beets. Averages in Ounces.	Average per cent. of Sugar.	Average Co-efficient of Purity.
	N A M E .			
1.	Dipp's Vilmorin.....	11	13.4	83.6
2.	Simon LeGrand's White Improved...	10	13.0	81.0
3.	Bulteau Desprez' Richest.....	11½	11.6	78.9
4.	Florimond's Desprez Richest.....	10½	10.8	76.2
5.	Dipp's Klenswazeblen.....	8½	12.3	78.5
General Average.....		10¼	12.2	79.7
The best lot of beets, averaged.....		23	20.9	94.7

The results of the twenty different fertilizer plots, did not vary enough to make it worth extending the records.

The general crop was harvested and stored by pitting, before any hard freezing weather. The five varieties were kept by themselves but (under orders from Washington) no distinction made between roots of same variety grown with different fertilizers.

E. H. B.

Note:—Since this report was prepared, the Chemist of the Department has found the sugar beets raised at this Station, of such exceptionally high quality, as compared with those grown in other parts of the country, that he has ordered all the roots remaining here to be sent to the Government Beet-Sugar Experiment Station, in Nebraska, to be there used for producing seed in 1891; a composite sample of the soil from our beet-field has also been asked for by the Chemist of the Nebraska Station. This seems to justify making this record, and also further efforts in growing sugar beets upon the farm of the Maryland Agricultural College.

H. E. A.

MARYLAND AGRICULTURAL EXPERIMENT STATION.

THE ANNUAL FINANCIAL REPORT, 1889-90.

*The Maryland Agricultural Experiment Station in account with
the United States Appropriation.*

1889.

DR.

July 1. To balance from last Report, p. 34..... \$1 35

1890.

June 30. To Receipts from the Treasurer of the United
States, in four payments, per appropriation
for the year ending June 30, 1890, under Act
of Congress, approved March 2, 1887,—see
ledger p. 46\$14,998 65

\$15 000 00

1890.	CREDITS.	LEDGER PAGE.	AMT.
June 30.	By Salaries paid.....	205	\$7,794 00
"	Labor,.....	216	1,680 00
"	Supplies	230	997 65
"	Library.....	253	250 62
"	Tools and apparatus.....	257	397 70
"	Scientific instruments.....	263	300 81
"	Fencing and drainage.....	283	327 43
"	Incidental expenses.....	292	312 17
"	Exhibitions and meetings.....	310	367 92
"	Feeding experiments.....	316	215 12
"	Expenses of board and travel....	320	485 70
"	Printing and office expenses.....	326	884 26
"	Soil examinations.....	330	237 53
"	Building and repairs.....	278	749 09
			\$15,000 00

I hereby certify that the foregoing Statement is a true copy from the books of
account of the said Experiment Station.

(Signed :)

J. D. HIRD,

Treasurer, pro tem.

NOTE:—Certificate of Auditors appended to original, forwarded to the Secretary of the Treas-
ury, Washington.

METEOROLOGICAL RECORD, 1890.

COMPARATIVE TABLE OF MONTHLY TEMPERATURES.

MONTH.	PLACE.						
	COLLEGE.	BALTIMORE.		CUMBERLAND.		WASHINGTON, D. C.	
	Mean. 1890.	Normal.	Mean. 1890.	Normal.	Mean. 1890.	Normal.	Mean. 1890.
January	44.8	34.3	44.0	31.2	43.5	32.6	43.8
February	43.8	37.0	43.4	33.0	42.4	36.1	43.4
March	40.5	42.1	41.6	38.1	38.7	41.4	41.4
April	53.1	53.1	54.0	51.0	54.0	52.8	53.6
May	62.9	63.9	64.0	62.0	61.9	63.6	63.8
June	73.9	72.3	75.0	69.7	74.2	71.5	74.8
July	75.7	78.6	75.4	73.7	77.4	77.6	75.0
August	74.0	74.5	74.1	71.1	73.4	73.5	73.6
September	66.0	68.2	68.4	63.9	66.5	67.4	67.8
October	55.2	58.0	57.0	53.3	56.2	57.3	56.4
November	46.5	47.1	48.2	41.3	47.7	46.4	48.0
December	33.5	38.5	34.6	33.5	34.2	37.8	34.2
Annual	55.8	53.1	56.6	51.8	55.8	54.8	56.3

METEOROLOGICAL RECORD, 1890.

COMPARATIVE TABLE OF MONTHLY RAINFALL.

MONTH.	PLACE.										
	College.		Baltimore.			Cumberland.			Washington, D. C.		
	Amount. 1890.	Rainy days.	Normal.	Amount. 1890.	Rainy days.	Normal.	Amount. 1890.	Rainy days.	Normal.	Amount. 1890.	Rainy days.
	In.	No.	In.	In.	No.	In.	In.	No.	In.	In.	No.
January.....	1.42	11	3.20	1.80	13	2.32	1.48	8	3.36	1.54	12
February....	3.97	15	3.54	4.80	13	2.43	3.66	11	3.31	4.20	15
March.....	3.36	18	4.09	4.07	16	2.79	4.94	13	4.20	3.65	18
April.....	2.34	13	3.27	3.94	13	2.22	3.51	10	3.16	2.81	11
May.....	4.48	19	3.55	5.98	18	3.37	7.31	14	3.90	4.73	16
June.....	1.25	9	4.09	2.42	6	3.43	3.12	10	4.29	2.02	9
July.....	2.42	10	4.94	3.61	10	3.54	1.73	4	4.65	3.24	9
August.....	4.83	15	4.48	6.44	15	3.27	7.18	11	4.44	5.50	17
September...	3.52	12	3.84	4.76	12	2.91	6.30	12	3.98	4.22	11
October.....	4.31	13	3.09	5.73	16	2.21	5.96	13	3.27	5.15	14
November...	0.69	6	3.15	0.74	9	2.26	1.42	5	2.91	0.79	6
December....	3.70	10	3.10	2.67	14	2.28	4.02	7	2.97	3.74	13
Annual....	36.29	151	44.34	46.96	155	33.19	50.63	118	44.44	41.59	151

METEOROLOGICAL RECORDS, 1890.

MONTHLY SUMMARY OF MEAN TEMPERATURES.

In Degrees Farenheit

MONTH.	Daily Mean.	Mean Daily Maximum.	Mean Daily Minimum.	Mean Daily Range.	Extreme Maximum. Date and Rec'd.	Extreme Minimum. Date and Rec'd.
January.....	44.8	55.0	32.5	22.5	12th—80	23d—14
February.....	43.8	53.9	33.2	20.7	26th—74	22d—21
March.....	40.5	52.8	31.7	21.1	28th—77	7th—13
April.	53.1	66.4	38.56	27.9	13th—82	2-6th—21
May.....	62.9	74.8	52.6	22.2	19th—86	9th—38
June.....	73.9	86.9	61.2	25.7	5th—96	9th—44
July.....	75.7	87.1	61.5	25.6	8th—102	22d—46
August.....	74.0	83.4	62.7	20.7	1st—97	24th—42
September.....	66.0	78.6	57.1	21.5	5th—91	25th—37
October.....	55.2	65.3	47.7	17.6	5th—78	31st—27
November	46.5	58.9	36.7	22.2	8th—74	29th—20
December....	33.5	44.3	25.0	19.3	23d—59	28th—12
Yearly Means.....	55.8	67.3	45.0	22.3	July 8th—102	Dec. 28th—12

METEOROLOGICAL RECORDS, 1890.

MONTHLY SUMMARY OF RAINFALL AND SUNSHINE.

1890. — MONTH.	RAINFALL.			SUNSHINE.	
	Total precipita- tion in inches.	Number of rainy days.	Actual duration. Hours and minutes.	Total possible. Hours and minutes.	Number of days without sunshine.
January.....	1.42	11	.....	.....	...
February.....	3.97	15	.....	.....	....
March.....	3.36	18	.....	.....	...
April.....	2.34	13	187—46	399—13	5
May.....	4.48	19	162—13	446—28	4
June.....	1.25	9	239—43	448—27	2
July.....	2.42	10	248—38	454—20	3
August.....	4.83	15	223—20	424—13	2
September.....	3.52	12	159—43	373—6	4
October.....	4.31	13	125—56	342—59	8
November.....	.69	6	*91—48	298—20	*2
December.....	3.70	10	.....	.....	....
Totals.....	36.29	151			

* Only 21 observations taken in the month.

METEOROLOGICAL RECORDS, 1890.

PRECIPITATION IN INCHES, (RAIN AND MELTED SNOW.)

DATE.	JANUARY.		FEBRUARY.		MARCH.		APRIL.	MAY.
	Total Precipitation.	Snow.	Total Precipitation.	Snow.	Total Precipitation.	Snow.	Total Precipitation.	Total Precipitation.
1.....	....	....	0.20	....	0.22	*	.	0.13
2.....	0.09	....	0.47	1.50	*	*	....	0.08
3.....	..	....	0.02	....	....	....	....	*
4.....	....	....	0.03	....	....	....	0.68	0.56
5.....	0.08	....	....	....	....	*	....	0.02
6.....	....	....	....	*	0.17	....	....	0.38
7.....	0.07	....	0.07	*	....	....	0.01	....
8.....	0.11	....	1.53	†	....	....	0.15	0.57
9.....	....	....	....	....	....	....	0.28	....
10.....	0.01	....	....	....	....	....	0.02	0.08
11.....	....	....	....	....	0.16	....	*	*
12.....	....	....	....	....	....	....	....	....
13.....	....	....	....	....	*	....	....	*
14.....	....	....	0.81	....	0.55	....	....	0.23
15.....	0.26	....	....	....	0.39	*	....	0.60
16.....	0.13	†	....	....	....	*	....	....
17.....	....	....	....	....	....	....	*	....
18.....	....	....	....	....	....	....	0.43	....
19.....	....	....	*	....	0.47	....	....	0.16
20.....	0.21	....	0.53	....	*	....	....	0.65
21.....	0.16	*	....	....	0.16	....	....	....
22.....	....	....	....	....	0.56	....	....	....
23.....	....	*	....	....	0.11	....	*	*
24.....	....	....	0.17	....	....	....	0.18	0.56
25.....	....	....	0.01	....	....	....	0.45	....
26.....	....	....	0.07	....	0.03	....	0.09	0.35
27.....	....	....	*	....	*	....	0.05	0.04
28.....	....	....	0.06	....	0.13	....	....	....
29.....	....	....	....	....	....	....	....	....
30.....	0.30	....	....	....	....	....	....	0.07
31.....	....	....	..	....	0.41	†	....	....
Totals..	1.42	*	3.97	1.50+	3.36	*	2.34	4.48

* Amount too small to measure.

METEOROLOGICAL RECORDS, 1890.

PRECIPITATION IN INCHES, (RAIN AND MELTED SNOW.)

DATE.	JUNE.	JULY.	AUGUST.	SEPT'R.	OCTOB'R.	NOV'ER.	DECEMBER.	
	Total Precipitation.	Total Precipitation.	Total Precipitation.	Total Precipitation.	Total Precipitation.	Total Precipitation.	Total Precipitation.	Snow.
1.....	....	....	1.53	....	.01	....	....	*
2.....	....	0.12	0.09	....	.17	*	....	....
3.....	....	*	....	....	....	....	.07	†
4.....	....	0.04	....	..	....	....	....	....
5.....	....	....	....	*	....	....	....	....
6.....	0.06	....	....	0.11	.51	....	....	....
7.....	....	....	....	....	.48	....	.09	....
8.....	....	....	1.40	....	....	....	.20	2.50
9.....	....	....	0.05	....	....	....	....	....
10.....	....	....	....	*	....	....	....	*
11.....	*	....	....	0.69	....	....	....	....
12.....	0.04	....	0.09	0.83	*	....	....	....
13.....	0.06	0.03	....	0.05	.06	.49	....	....
14.....	....	....	*	} 1.17	.08	....	....	....
15.....	....	....	0.85		....	.07	....	....
16.....	....	....	....	*	.35	....	....	....
17.....	*	....	....	0.03	....	*	1.15	....
18.....	*	0.01	0.15	....	*	....	....	....
19.....	....	....	*	....	*	.13	....	....
20.....	....	....	0.27	....	....	....	....	....
21.....	0.19	....	0.06	*	....	....	....	....
22.....	0.77	....	0.18	....	....	....	....	....
23.....	....	....	....	....	2.25	....	....	....
24.....	....	0.02	....	....	.39	....	....	....
25.....	....	1.31	*	....	....	....	....	....
26.....	....	0.65	0.02	.61	.01	....	} 2.29	....
27.....	....	0.12	0.14	.03	....	....		....
28.....	....	0.12	....	....	....	....		....
29.....	0.13	....	....	....	....	....		....
30.....	....	....	....	....	*	....		....
31.....	....	....	....	....	..	....	....	....
Totals..	1.25	2.42	4.83	3.52	4.31	0.69	3.70	....

† Followed closely by rain and could not be measured.

METEOROLOGICAL RECORDS, 1890.

SUNSHINE, IN HOURS AND MINUTES.

Date.	April.	May.	June.	July.	August.	Sept.	October.	Nov.
	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
1.....	5—0	6—48	10—20	4—34	8—15	10—22	2—32	6—53
2.....	10—40	10—19	10—27	none	11—31	4—59	none	5—17
3.....	12—45	3—50	6—49	4—4	6—4	9—53	8—0	none
4.....	3—0	none	10—55	10—32	6—4	8—47	8—0	0—30
5.....	12—30	8—10	11—4	10—9	10—29	6—14	8—10	7—50
6.....	9—48	1—32	6—44	12—0	6—7	2—12	none	6—45
7.....	6—4	2—44	9—9	12—46	9—4	6—1	none	2—37
8.....	none	5—32	10—49	12—0	4—0	4—30	9—52	2—23
9.....	0—30	7—45	12—10	12—5	8—55	3—50	11—0	6—36
10.....	3—50	none	6—3	11—50	2—24	6—24	9—13	.....
11.....	10—14	none	10—22	12—0	5—4	3—45	2—25	.....
12.....	10—2	10—44	11—6	3—0	6—42	2—15	none	.....
13.....	8—57	6—14	8—15	3—30	10—29	none	none	.....
14.....	6—6	7—50	5—12	4—10	6—29	none	3—55	.....
15.....	4—15	2—7	8—10	6—37	8—59	4—15	9—54	.....
16.....	7—45	5—3	none	10—39	10—49	none	none	.....
17.....	none	10—20	1—54	10—44	9—39	9—38	9—3	none
18.....	6—14	8—4	7—55	10—45	none	9—30	8—38	2—30
19.....	9—27	4—25	12—0	11—3	4—10	10—17	2—50	6—6
20.....	9—19	5—55	10—56	10—54	none	5—42	2—15	4—0
21.....	8—15	6—44	none	10—17	4—30	8—49	4—0	6—55
22.....	9—1	2—10	8—15	11—4	6—50	3—45	1—56	6—1
23.....	6—44	5—54	4—10	5—10	9—45	8—45	none	5—35
24.....	none	1—3	5—5	none	8—49	9—38	3—30	7—34
25.....	none	0—30	11—4	0—28	4—30	6—20	0—30	0—51
26.....	none	none	10—37	4—0	3—50	none	none	4—43
27.....	2—18	6—9	10—32	6—15	7—5	0—50	4—38	1—19
28.....	9—2	9—36	6—32	none	10—50	none	4—57	7—23
29.....	8—15	8—15	5—30	10—17	10—58	9—20	2—28	.....
30.....	7—45	6—45	7—45	13—30	10—59	6—33	4—57	.....
31.....	.....	7—45	.....	13—45	10—9	.....	3—13	.....
Sums...	H. M. 187—46	H. M. 162—13	H. M. 239—43	H. M. 248—38	H. M. 223—20	H. M. 159—43	H. M. 125—56	H. M. 91—48

SUMMARY OF STATION WORK,

FOR THE YEAR 1890.

Agriculturist's Report, (pages 90 to 103.)**Corn**—Soil Test with Fertilizers and Corn, (p. 90.)

22 Plots; 18 different Fertilizers; 2 varieties Corn.

Results:—**a.** Nitrogen increased yield in all cases, (p. 93.)

\$4.00 worth Nitrate of Soda produced 19 bushels Corn.

Muriate of Potash used alone, unprofitable.

b. Phosphoric acid alone gave no increase of crop.**c.** Phos. acid or Potash, or both, added to Nitrogen gave no profitable increase.**d.** "Complete fertilizer" gave largest yield dried fodder.**Co-operative Corn Test**—described; seven Stations co-operating, (page 94.)

Northern varieties failed; very heavy growth of Texas corn.

Forage Garden—**a.** Grasses; Red Top, Tall Oat, and Orchard Grass commended; Johnson Grass, also, conditionally.**b.** Clovers; compared. Japan clover found useful, (p. 96.)**c.** Forage plants; Unknown Pea and Soja Bean favorably reported upon, (pp. 97, 98.)**Wheat**—Variety test, with 45 varieties, the Dietz leading. Details in Bulletin No. 10, Sept'r, 1890.**Oats**—Variety test, with 40 varieties; crop and test failed.**Rotation**—Record continued from last year, (p. 99.)

No marked results except favorable effect stable manure.

Silos and Ensilage—Another year's experience, (p. 101.)

Storing ensilage in 1890; filling the different silos.

Drains—Record of work completed, (p. 102.)**Hay Cap**—Report of trial of Symmes Hay Cap, (p. 103.)

Convenient and efficient, but expensive.

Horticulturist's Report, (pp. 104 to 117.)**Tomatoes**—Reference to record in Bulletin 11, Dec'r, 1890.

Strawberries—Reference to record in Bulletin 9, June, 1890.

Differences in varieties as to Leaf Growth and Blight.

Table of comparisons, and notes, (pp. 105-6.)

Remedies described, (pp. 106-107.)

Potatoes—Verification work as to size of seed, (p. 108.)

Former conclusions re-affirmed, (p. 110,) viz:

- Conclusions:—**1.** The greater the quantity of seed tuber planted, the greater the crop in total product,
- 2.** Generally, the more seed, the more good potatoes.
- 3.** The most profitable seed, usually, whole potatoes egg size.
- 4.** The less the seed and the more cut, the poorer the stand.
- 5.** Lessening seed increases missing hills and reduces crop.

Northern Seed Potatoes for Profit—Comparative Test, (p. 111.)

Vermont and Maryland-grown tubers for seed.

The former gave much better results in every case.

Test Orchards—

Nursery—

Vineyard and Grape Culture—

Botanical Laboratory—

} Described and future work outlined,

(pp. 112-14.)

Orchard Fertilizer Test—Record to date; no results yet, (p. 114.)

Blackberry Rust—Varieties compared, as to health, (p. 115.)

The healthiest: The Wilsons, Wachusett, Early Harvest, Crystal White and Thompson's Early Mammoth.

Vegetable Tests—Sundry Notes. (p. 116.)

Chemist's Report, (pp. 118 to 129.)

Work of the Year—280 samples and over 2000 determinations.

Marls—Descriptions and analyses of samples, (pp. 119-124.)

Tables, Composition of Maryland Marls and Mucks, (p. 125.)

Laboratory Methods—Study of same, (p. 126.)

Use of Animal Charcoal in Fat Determinations in Feeding Stuffs.

Conclusions given, (p. 129.)

Machinist's Report, (pp. 130-134.)

General Duties—Boiler & Coal—Pumping & Power—(p. 130.)

New Farm Implements—Description, efficiency and cost, (p. 131.)

- a. Empire Thresher,—Harder's.
- b. Combined Horse Rake and Tedder,—Dayton, Ohio.
- c. Insecticide Gun,—Leggett Bros., New York.

Needs of Department, and Recommendations—(p. 131.)

Special Report on Sugar Beets—with Table, &c., (p. 133.)

Treasurer's Annual Report, (p. 135.)**Meteorological Records, 1890,** (pp. 136-142.)

- Tables**—**a.** Comparative Monthly Temperatures.
b. Comparative Monthly Rainfall.
c. Monthly Summary of Mean Temperatures.
d. Monthly Summary of Rainfall and Sunshine.
e. Rainfall, daily, for 12 months.
f. Sunshine, daily duration, April to November, inclusive.

Director's Report, (pp. 77 to 89.)

Note:—Besides references to most of the subjects above named, this Report mentions the following :

The Season—Its peculiarities and Weather Summary, (p. 77.)

Tobacco—Reasons for previous omission ; Plans for 1891, (p. 80.)

Feeding Experiments—Work in progress, (p. 80.)

Ensilage—The system no longer an experiment, (p. 81.)

Variety Tests—Their use and value, (p. 82.)

Work of Verification—An important Station duty, (p. 83.)

Soil Tests—Place and purpose, in Station work, (p. 84.)

Soil Examinations—Prospective work in Maryland, (p. 85.)

Co-operative Work—That of 1890 recited, (p. 85.)

Improvements at the Station—Described, (p. 86.)

Exhibitions and Meetings—in 1890. Usefulness, (p. 87.)

Visitors—Publications—Correspondence—(p. 88.)

Station Staff—Change of Horticulturist, (p. 89.)





